Rev. February 1985

Instruction Manual

MODEL 1100-AR SERIES
TELEMETRY RECEIVER
S/N 399 and above

July 1972

TRADE SECRETS

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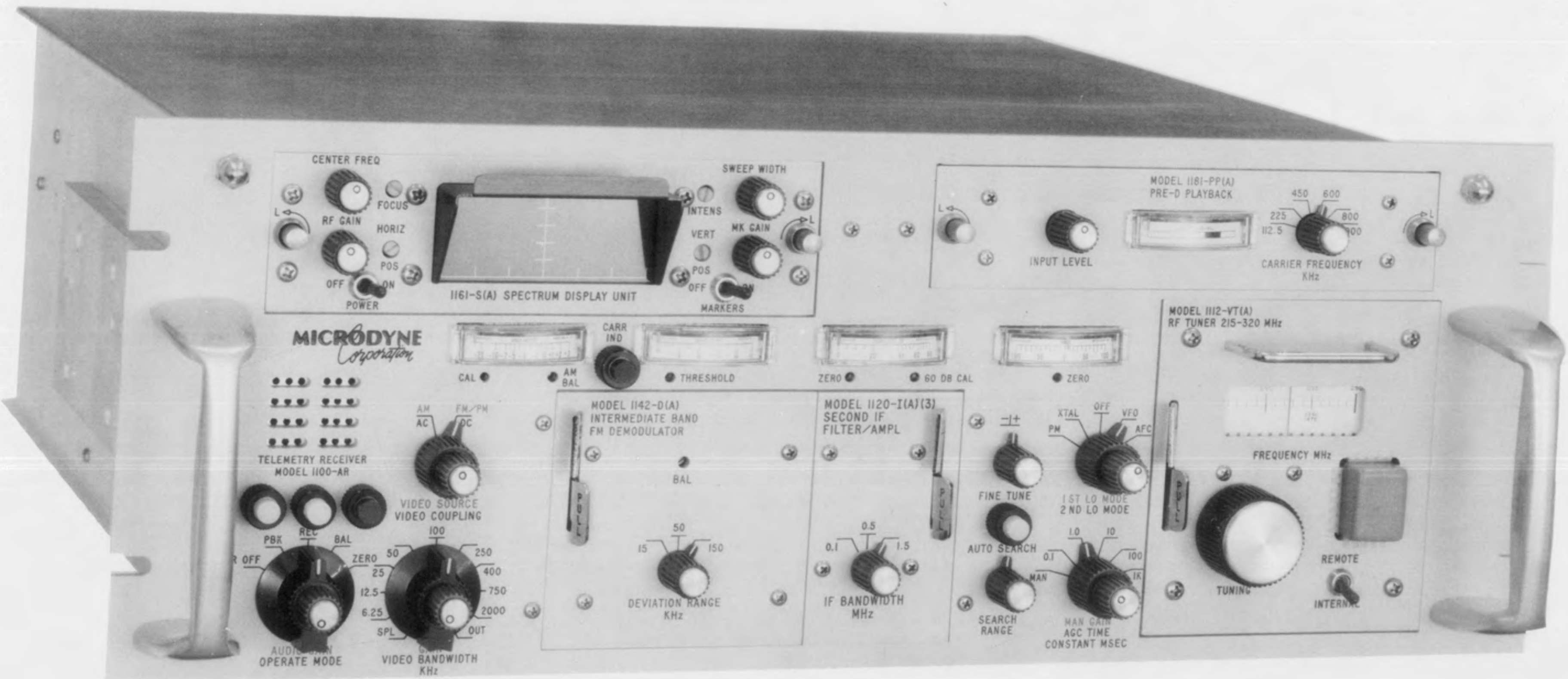


Figure 1-0. Model 1100-AR Telemetry Receiver, Typical Configuration

SECTION I
GENERAL INFORMATION

1.1 INTRODUCTION

This instruction manual provides operation and maintenance information for the Model 1100-AR Telemetry Receiver, designed and manufactured by Microdyne Corporation. The 1100-AR is a highly adaptable, completely modularized receiver which can be easily integrated into ground station and laboratory applications by simply selecting the module complement on order.

Being extremely versatile, the 1100-AR can be easily configured as a low-cost general purpose receiver supplying the minimum number of outputs, or as a complex data receiver with predetection record and playback capabilities, automatic search and lock for signal acquisition and spectrum analysis by simply selecting the module complement.

Because of the many combinations of modules available for the 1100-AR, this manual is constructed to be readily adaptable to any receiver configuration. It is composed of seven individual sections preceded by a receiver configuration page and contents pages. The receiver configuration page provides a listing of which modules are supplied in the associated receiver configuration and if applicable, special modifications or options. Using the information presented on this page, Sections I through VII can be modified as required to match the receiver. For example, if the applicable receiver does not contain playback or record capabilities, the information pertaining to these items can be designated as not applicable. Maintenance procedures, replaceable parts lists and schematic diagrams are adapted in a like manner.

Manuals supplied for special receivers which have been slightly modified to meet particular requirements contain an Addendum which thoroughly describes the modification and the effects it has on overall procedures and parameters. Also included are any special instructions for modifying operating and maintenance procedures, parts lists and schematic diagrams.

The final portion is composed of the instruction booklets for each plug-in module or a group of related modules excluding front panel plug-in modules. Included in each booklet is the theory of operation, special mounting procedures, repair and alignment procedures, parts lists and schematic diagrams. The number of booklets contained in this section depends upon the module complement of the associated receiver.

Front panel modules, because of their complexity, are supplied with a complete instruction manual. These manuals are provided as supplements to this manual and may or may not be bound in this volume.

1.2 PURPOSE AND DESCRIPTION

The Microdyne Model 1100-AR Telemetry Receiver is an advanced general purpose telemetry receiver featuring solid-state design through full use of integrated circuits and subminiature components. The 1100-AR is capable of receiving and processing any telemetry data format. The standard frequency ranges include 105 to 2300 MHz with discrete ranges to 6000 MHz available.

The receiver can be supplied in either of two basic configurations designated 1100-AR(5) and 1100-AR. The 1100-AR(5) has a 5-1/4 inch panel height and the

Purpose and Description, continued

1100-AR has a 7 inch panel height. The 1100-AR, with its 7 inch panel, has front panel provisions for a spectrum display unit and pre-d converters. Both configurations comprise front panel and internal modules that may be selected to meet the specific system requirements.

The building block concept of modular construction allows the 1100-AR to be configured for a wide variety of purposes and uses. In its most basic configuration, it is a low-cost general purpose receiver while in another configuration it is a complex data receiver with pre-d record and playback capabilities, automatic search and lock for signal acquisition, and spectrum analysis. If desired, the unit can be completely controlled by a computer or from a remote location.

The use of monolithic integrated circuits reduces component density and increases overall receiver reliability to a calculated MTBF in excess of 7,500 hours. Reduced component density increases maintainability to the extent that the MTTR for the 1100-AR is approximately 30 minutes.

Gain distribution is optimized by controlling signal and noise levels at all receiver interface points. Receiver gain, prior to second IF band limiting, is as low as possible to achieve optimum receiver noise figure characteristics.

The 1100-AR employs linear-phase steep-skirted IF filters to optimize phase nonlinearity in the second IF filter/amplifier without compromising the filter shape factor and subsequent degrading overall receiver selectivity.

The AFC circuitry provides variable automatic search and lock as well as high drift reduction AFC. The front panel adjustable search continues until a threshold signal appears in the second IF passband. At this point, receiver lock is automatically accomplished.

The 1100-AR can be used in predetection recording systems. An auxiliary front panel plug-in slot can accomodate either an 1181-PP(A) Predetection Playback Converter or an 1171-PR(A) Predetection Record Converter. These units provide a full capability for pre-d up and pre-d down conversion with a choice of six switch selectable record frequencies. Single frequency up and down converters are also available as internal plug-in modules.

The 1100-AR receivers are also adaptable to predetection or post detection diversity combining applications. The receiver AGC outputs which are available for controlling the combiner also have several operational advantages. These include reversible polarity, adjustable slope, and zero offset adjustments. Additionally, the receiver furnishes two logic signals indicating loss of carrier and AFC/APC search.

Front panel controls are grouped logically for ease of operation with concentric switches used in related areas. Multicolor lamps indicate playback, receiver, or calibration operating modes, carrier presence and automatic search. Meters display video output level, signal level, tuning error and loop stress, and deviation. Calibration controls are conveniently located adjacent to each respective meter.

The electrical, environmental and mechanical specifications are given in Table 1-1.

1.3 MODULE DESCRIPTIONS

Brief descriptions of the receiver modules are given in the following paragraphs. A modular layout illustration is shown in Figure 1-2.

1.3.1 RF TUNER (Front Panel)

A series of RF tuners covering discrete frequency bands is available for use with the 1100-AR to enable reception of RF carriers ranging from 105 MHz to 6000 MHz. These units are available in both voltage tuned and mechanically tuned models. The voltage tuned "D" series tuners are available with digital readout displays for indicating the received frequency. The "SYN" series of tuners offers synthesized tuning. The tuners function to down convert the selected RF input to a 50 MHz IF signal for further processing. The voltage tuned versions have the additional capability of being controlled by a voltage input from a remote tuning console or computer interface.

1.3.2 DEMODULATORS (Front Panel)

Demodulator modules are available for the processing of FM, phase, and bi-phase data. FM demodulators comprise three basic units, each of which covers a certain range of IF bandwidths. A narrow band unit covers up to and including 50 KHz, and intermediate and wide band units cover ranges of 100 KHz to 750 KHz and 750 KHz to 6 MHz. In addition, the intermediate and wide band units or all three ranges can be supplied in a single housing. The wide angle phase demodulator may be used with any IF bandwidth and is capable of retrieving PM data having peak deviations up to 2.8 radians. This module may be equipped with an option anti-sideband lock feature which effectively prevents sideband lock on signal acquisition. A bi-phase demodulator is available for use with IF bandwidths exceeding 100 KHz. Capabilities of this unit include demodulation of a ±90 PSK, bi-phase modulated signal at bit rates between 1 bit and 2 megabits, NRZ. It also is equipped with the anti-sideband lock feature.

1.3.3 SECOND IF FILTER/AMPLIFIERS (Front Panel)

The second IF filter/amplifier modules are employed to establish the bandwidth of the 10 MHz second IF signal. Both fixed and variable bandwidth units are available. Each of the fixed bandwidth models sets a single bandwidth in the range of 10 KHz to 6 MHz. Up to three of these filter/amplifiers can be installed in a module housing to enable multi-bandwidth operation. Modules of this type are equipped with a front panel selector switch. Variable bandwidth models are voltage tuned and are equipped with a front panel dial to permit selection of any IF bandwidth within its operating range. One such unit is the Model 1120-VI(600) which is capable of setting any bandwidth from 100 KHz to 600 KHz.

1.3.4 FIRST IF FILTER (Optional)

The first IF filter space in the receiver may be equipped with any one of three types of modules as selected by the customer on order. The first type of module supplies steep-skirted filtering of the first IF signal and establishes either a 600 KHz, 1.2 MHz or 4 MHz bandwidth. The second type contains any two of the standard or special bandwidths and is automatically switched by the second IF filter/amplifier. Both of these modules supply an isolated 50 MHz output for display purposes. The third type of module supplies no filtering whatsoever but provides a 50 MHz output for display purposes. A first IF filter is required if a spectrum display unit is used.

1.3.5 SECOND MIXER

The second mixer accepts the 50 MHz first IF input and a 60 MHz second local oscillator input, and provides a 10 MHz second IF output. When the receiver is used in the playback configuration, the 50 MHz pre-recorded signal is injected into the second mixer and processed identically to the normal first IF signal.

1.3.6 SECOND LOCAL OSCILLATOR

This module supplies the 60 MHz LO signal to the second mixer. The oscillator may be operated in any one of five modes to supply the required signal. These modes, VFO, CRYSTAL, AFC, PM or OFF, are controlled by a front panel switch. In the VFO mode, the frequency is controlled by a front panel fine tune control. In the AFC and PM modes, the frequency is controlled by a voltage generated by AFC circuitry or the phase demodulator (PM). When set to the CRYSTAL mode, a fixed 60 MHz signal is generated. The OFF position permits the injection of an external 60 MHz input.

1.3.7 AM DETECTOR

An AM detector module is employed in the 1100-AR to detect any AM data, derive the raw AGC voltage for gain control, and provide both linear and limited 10 MHz outputs for recording.

1.3.8 CALIBRATE/REFERENCE OSCILLATOR

The calibrate/reference oscillator serves a dual function. It provides a 10 MHz output which is employed to calibrate FM systems and it serves as a reference for PM systems.

1.3.9 VIDEO FILTERS

The video filters are employed in the receiver to establish the video cutoff frequency. Any two of seven video filter modules can be included in the 1100-AR main chassis. Each of the modules contains a number of video filter circuits in various combinations as selected by the customer. Selection of which filter used is made through a front panel switch. In addition, a third filter can be installed to establish a special non-standard cutoff frequency as specified by the customer.

1.3.10 VIDEO AMPLIFIER

The detected and filtered video signal is amplified by this module and coupled to a rear apron connector. A second output of this module also drives the front panel output meter. The gain of the video amplifier is adjustable through a front panel control.

1.3.11 AGC AMPLIFIER

The AGC amplifier contains three separate circuits: an AGC amplifier, an AGC output amplifier and a carrier operated relay (COR). The AGC amplifier circuit is driven by an output from the AM detector and is used to control the gain of the tuner, second mixer, and second IF filter/amplifier. This amplifier circuit also feeds the signal level meter on the front panel of the receiver. Various AGC time

AGC Amplifier, continued

constants from 0.1 milliseconds to 1 second are selectable through a front panel switch. The output voltage can also be manually set to the desired level through a selector switch and potentiometer.

The AGC output amplifier circuit is used to amplify the output of the AGC amplifier circuit and feed it to a rear panel connector. Signals appearing at this connector can then be recorded or applied to combining equipment as required. The COR circuit is also driven by the AGC amplifier circuit. This relay causes a front panel lamp to light when the receiver carrier is above preset threshold level. A double set of single pole double throw relay contacts (appearing at a rear panel connector) is also provided by the COR. These contacts operate when the front panel carrier lamp lights and may be used to control remote indicators.

1.3.12 METERING AMPLIFIER

The metering amplifier module supplies the drive voltages to the receiver deviation and output meters. These voltages are initially derived from the plug-in demodulator and video amplifier, respectively. Also contained in the metering amplifier module is a bridge amplifier circuit. This stage is employed to regulate the oven temperature when a crystal oven is installed in the tuner.

1.3.13 AFC AMPLIFIER

The AFC amplifier contains automatic sweep circuitry in addition to the normal AFC circuit. The automatic sweep circuit is employed in both the AFC and PM modes of operation to generate search voltages to the second LO to enable automatic search and lock after signal dropout. Outputs are also provided to control the search indicator lamp and to drive the tuning meter.

1.3.14 PLAYBACK CONVERTER (Optional)

Two types of playback converters are available for use with the 1100-AR. These are designated 20-1100 series and 100-117 series. When a receiver is equipped with a 20-1100 series, any one of the six standard video record carriers is up converted to 50 MHz and injected into the second mixer. When the receiver is equipped with a 100-117 series converter, a 10 MHz signal is up converted to 50 MHz and injected into the second mixer.

1.3.15 RECORD CONVERTER (Optional)

The record converters designed for use with the 1100-AR are designated 10-1100 series. There are six standard modules available, each of which supplies a single video record carrier output taken from a rear apron connector. The input to this module is supplied by the limited or linear 10 MHz output.

1.3.16 DISPLAY CONVERTER (Optional)

A display converter can be installed in the receiver to permit mating the 1100-AR with a spectrum display unit having an input frequency requirement of other than 50 MHz. This module accepts the 50 MHz IF signal and converts it to the customer specified frequency with unity gain.

1.3.17 SPECTRUM DISPLAY UNIT (Optional)

The Model 1161-S(A) Spectrum Display Unit can be installed directly into the top left side equipment space in the 1100-AR receiver only. When used with the 1100-AR(5), it must be installed in a separate housing. The 1161-S(A) accepts the 50 MHz IF signal and provides a visual representation of signals appearing in a 5 MHz passband on a CRT. All controls necessary for operation of the display unit are locked on its front panel.

1.3.18 PREDETECTION RECORD CONVERTER (Optional)

The Model 1170-PR(A) series of Predetection Record Converters is also designed for use in the 1100-AR receiver. A separate housing is available for use with the 1100-AR(5). This module accepts the linear or limited 10 MHz IF signal and provides any of six video record carrier outputs. Selection of the output frequency is made through a front panel switch.

1.3.19 PREDETECTION PLAYBACK CONVERTER (Optional)

The Model 1180-PP(A) series of Predetection Playback Converters is a third auxiliary plug-in for the 1100-AR. Like the display unit and companion 1171-PR(A) record converter, it also can be placed in a separate housing for use with the 1100-AR(5). The unit accepts any of the six standard video record carriers and up converts it to 10 MHz. This signal is then patched to the 100-117 (10 to 50 MHz) converter and injected into the second mixer. A front panel switch is provided for selecting the particular video carrier input. The unit is also equipped with a level adjustment and meter to enable optimum operation.

1.3.20 CENTER FREQUENCY OFFSET AND AUXILIARY AGC OUTPUT MODULES (Optional)

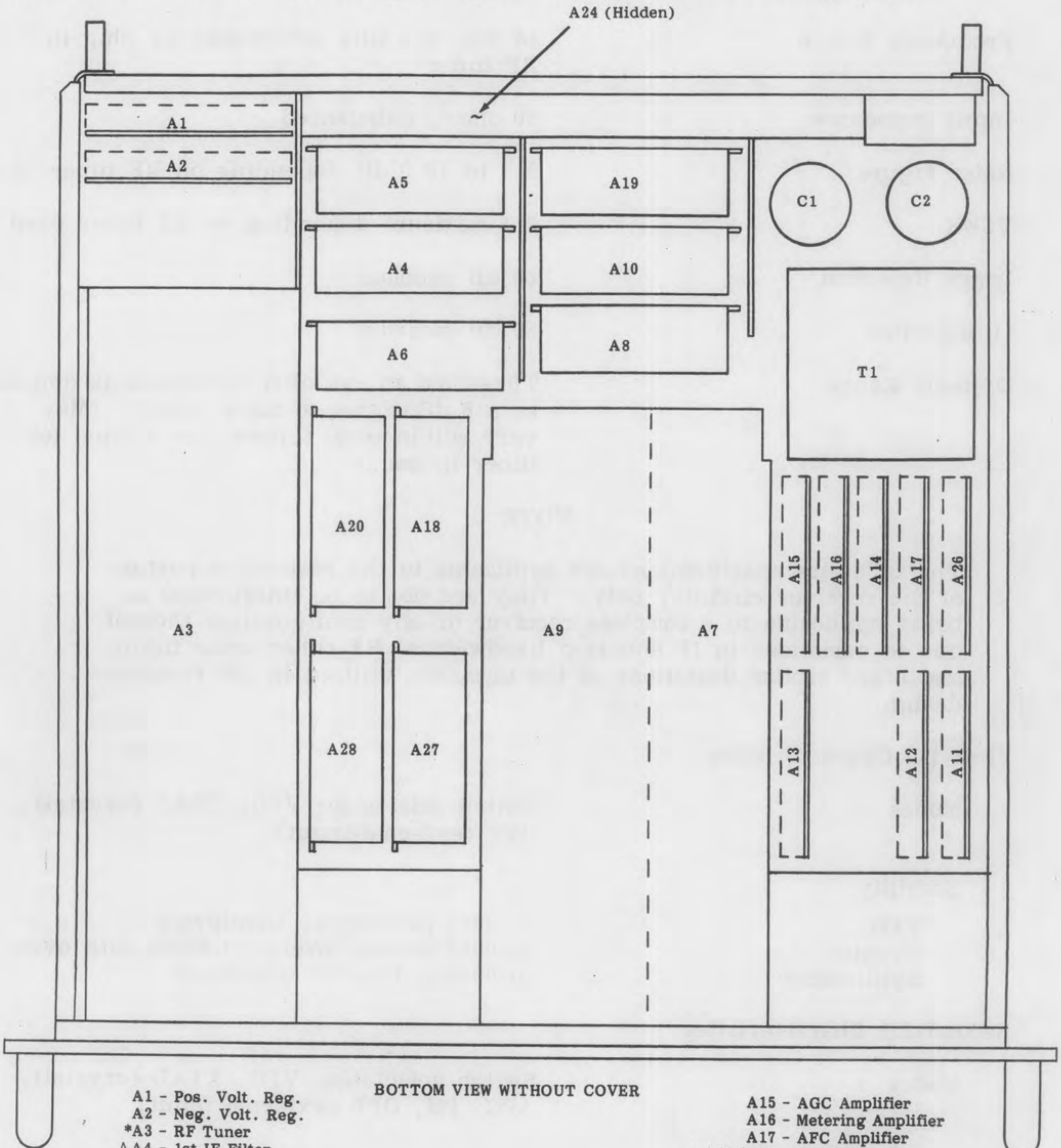
Center frequency offset (CFO) and auxiliary AGC output modules are available for the 1100-AR. The CFO modules provide a DC voltage output proportional to the frequency offset of the received signal in relation to the receiver IF center frequency. The CFO circuitry is operable in all receiver modes of operation.

The auxiliary AGC output modules provide a buffered AGC voltage output for driving external recorders or diversity combiners. The output ranges from 0 to 8V DC and can be of either positive or negative polarity depending on customer requirements. Included on these modules are slope and zero adjustments for setting the AGC output to match the input requirements of the external equipment. Additionally, both the CFO and auxiliary AGC output capabilities can be included in a single module. The model numbers and capabilities of the four modules in this series are:

- 41-1100 CFO output only. Unless otherwise specified, the sensitivity is factory set to 100 KHz/volt with a 2V p-p maximum output.
- 42-1100 Auxiliary AGC output only; 0 to -8V DC output range.
- 43-1100 Auxiliary AGC output only; 0 to +8V range.
- 44-1100 CFO and auxiliary AGC outputs. Unless otherwise specified, the CFO sensitivity is to 100 KHz/volt with a 2V p-p maximum output. The AGC output ranges from 0 to -8V DC; the polarity can be set positive to provide a 0 to +8V DC range if specified at time of order.

1.3.21 SIMULTANEOUS AM-FM/PM OUTPUT

Optional feature 45-1100, using a low level auxiliary video amplifier, provides a continuous AM video output regardless of the position of the receiver video switch. This adjustable AM video signal is provided simultaneously with the video signal selected by the video switch and is especially suitable as an AM tracking output.



BOTTOM VIEW WITHOUT COVER

A1 - Pos. Volt. Reg.
A2 - Neg. Volt. Reg.
*A3 - RF Tuner
ΔA4 - 1st IF Filter
A5 - 2nd Local Osc
A6 - 2nd Mixer
*A7 - 2nd IF Filter/Amp.
A8 - AM Detector
*A9 - Demodulator
A10 - Cal/Ref. Osc.
A11 - Video Filter #1
A12 - Video Filter #2
ΔA13 - Video Filter Special
A14 - Video Amplifier

* Front Panel Module
Δ Optional Modules

A15 - AGC Amplifier
A16 - Metering Amplifier
A17 - AFC Amplifier
Δ A18 /A27 - Playback Conv.
ΔA19 - Record Conv.
ΔA20 - Display Conv.
A21 - Front Panel
A22 - Base Chassis
Δ*A23 - Spectrum Display Unit
A24 - Display Regulator
Δ*A25 - Pre-D Record/Playback Conv.
A26 - Not Assigned
ΔA28 - SDU Buffer

Figure 1-1. Receiver Configuration

Table 1-1. Specifications

ELECTRICAL

Receiver Type	Double superheterodyne; 50 MHz first IF; 10 MHz second IF
Frequency Range	65 MHz-4.2 GHz determined by plug-in RF tuner
Input Impedance	50 ohms, unbalanced
Noise Figure	5.5 to 10.0 dB depending on RF tuner used
VSWR	2:1 maximum depending on RF tuner used
Image Rejection	60 dB minimum
IF Rejection	80 dB minimum
Dynamic Range	Threshold to -10 dBm (threshold is defined as a 6 dB signal-to-noise ratio). (May vary within some tuners; see manual for tuner in use.)

NOTE

The following specifications are applicable to the respective portion of the receiver circuitry only. They are not to be interpreted as being applicable to a complete receiver or any configuration thereof due to variations in IF and loop bandwidths, RF tuner noise figure and other similar limitations of the circuitry utilized in the receiver design.

First LO Characteristics:

Modes	Switch selectable: VFO, XTAL (crystal), OFF (external input)
Stability:	
VFO	±0.001% per degree Centigrade
Crystal	±0.005% without oven; ±0.0005% with oven
Synthesizer	±0.0005%, 0 to 50° C ambient

Second LO Characteristics:

Modes	Switch selectable: VFO, XTAL (crystal), AFC, PM, OFF (external input)
Stability:	
VFO	±0.001% per degree Centigrade
Crystal	±0.005%

continued

Table 1-1. Specifications, continued

AFC Characteristics:	
Tracking Range	±400 KHz in addition to ±250 KHz fine tune control
Acquisition Range	Up to ±400 KHz from center frequency in addition to ±250 KHz fine tune control
Drift Reduction Factor	Greater than 10,000:1
Search Range	50 KHz to greater than 800 KHz; approximately symmetrical about second LO frequency as set by front panel fine tune control
Search Rate	1.5 MHz/second
PM Characteristics:	
Control Range	±250 KHz in addition to second LO fine tuning range
Search Range	50 KHz to greater than 500 KHz; approximately symmetrical about second LO frequency; set by loop bandwidth control
Phase Loop Bandwidth	10, 30, 100, 300, 1000 Hz as determined by positioning of PM demodulator loop bandwidth switch
Demodulation:	
FM Demodulation	Refer to applicable FM demodulator manual
PM Demodulation	Refer to applicable PM demodulator manual
AM Demodulation:	
AM Response	5 Hz to one-half IF bandwidth (1.6 MHz maximum)
AM Distortion	Less than 3% with 90% modulation at a 1 KHz rate
AGC Time Constant	Switch selectable; 0.1, 1.0, 10, 100, 1000 msec normally supplied. Others available
Video Characteristics:	
Output Impedance	75 ohms
Rated Output	4 volts peak-to-peak
Maximum Output	10 volts peak-to-peak

continued

Table 1-1. Specifications, continued

Video Characteristics, continued	
Distortion	Less than 0.5% at rated output; less than 1% at maximum output
Source	Plug-in demodulator or AM detector
Coupling	AC or DC; switch selectable
Response	AC coupled - 5 Hz to 2.0 MHz +1.0 dB -3 dB DC coupled - DC to 2.0 MHz +1.0 dB -3 dB
Power Requirements	115/230V AC ±10%, 50-400 Hz, 35 watts - 1100-AR(5) or 50 watts - 1100-AR maximum
ENVIRONMENTAL	
Temperature Range:	
Storage	-62° to +65° Centigrade
Operating	0° to +50° Centigrade
Atmospheric Pressure:	
Storage	To 50,000 feet (15,240 m)
Operating	To 15,000 feet (4,572 m)
Humidity	To 95% relative humidity
MECHANICAL	
Height	5-7/32 inches (13.04 cm) 1100-AR(5) 6-31/32 inches (17.42 cm) 1100-AR
Width	19 inches (47.50 cm)
Depth	19-1/4 inches (48.12 cm)
Weight	1100-AR(5) approximately 35 pounds (15.88 kg) 1100-AR approximately 42 pounds (19.05 kg)

SECTION II
INSTALLATION

2.1 INTRODUCTION

This section contains installation information for the Model 1100-AR Telemetry Receiver in both the 5- and 7-inch configurations. Instructions are also included for handling, storage and packaging for reshipment.

2.2 UNPACKING AND HANDLING

The 1100-AR is shipped with all internal subassemblies installed; front panel modules are shipped separately to prevent possible in-transit damage. The receiver and power cord are sealed in a polyethylene bag and packed in a polystyrene shipping case which is sealed with tape. To open the case, lay it flat with the top side up. Cut the tape and remove the receiver package. Place the receiver on a bench and remove the bag. Thoroughly check the receiver for in-transit damage; i.e., broken meter faces, damaged connectors, dents, broken knobs. If damaged, notify the proper authorities immediately.

NOTE

Do not destroy the packing case if the receiver is to be stored or transferred to another site.

Prior to installing the receiver, remove the bottom cover and ensure that all modules are firmly secured in their receptacles. This may be done by simply pushing each module down into the receptacle. If the receiver was ordered with rack slides, the receiver portions of the slide assembly are installed before shipment and the rack portions shipped in a separate carton.

2.3 INSTALLATION

2.3.1 MECHANICAL

The 1100-AR is designed for mounting in a standard 19-inch equipment rack. No special hardware is required to mount the receiver whether or not it is equipped with slides (Microdyne RSA-11). The 1100-AR(5) requires 5 inches of vertical space and the 1100-AR requires 7 inches of vertical space.

2.3.2 ELECTRICAL

After mounting, all interconnections between the receiver and other equipment should be completed. Table 2-1 provides cabling requirements for the 1100-AR and includes the connectors and their functions, reference designations, types and impedances. A rear view of an 1100-AR is shown in Figure 2-1. Because of the many options available, certain rear apron connectors may or may not be supplied.

2.3.3 PRIMARY POWER

Unless otherwise requested, the 1100-AR is shipped wired for operation with a 115V AC input. Should it become necessary to operate at 230V AC, the primary T1 (terminals 1 through 4) must be rewired for 230 volt operation. Figure 2-2 shows the transformer wiring for both 115V AC and 230V AC operation. Access to T1 is obtained by removing the top cover. A power cord is supplied for connecting the receiver to the primary power outlet.

2.3.4 FRONT PANEL MODULE INSTALLATION

Two methods are employed to secure the receiver front panel modules. One type is used on both of the receiver configurations and consists of a release latch and bail. To install a module in the receiver, raise the top part of the mechanism in the direction of the arrow. Extend that bail marked PULL to limit. Insert the module into its slot and return the PULL handle to its original position until the latch lock engages.

NOTE

> To install a demodulator into the receiver, the demodulator must first be mated to the companion IF filter and the two units installed together. The same procedure applies when installing an IF filter.

The second method of securing modules is evident on the 1100-AR only. This method involves the use of pawl fasteners and thumbscrews and is employed on the auxiliary modules only. To install a module which employs this type of fastener, adjust the thumbscrews until the pawls are retracted. Insert the module into its slot and adjust the thumbscrews as necessary to tighten the pawls.

2.3.5 INITIAL ADJUSTMENTS/CALIBRATION

Initial adjustments and calibration procedures are given under paragraph 3.7 in Section III.

2.4 STORAGE AND HANDLING

When storing or transporting the receiver, the environmental storage conditions given in Table 1-2 must not be exceeded. No special equipment is required to handle the receiver although care should be exercised to prevent excessive shock and vibration.

2.5 PACKAGING FOR RESHIPMENT

Should it become necessary to repack the receiver for shipment, proceed as follows:

a. Remove the front panel modules and package them following the instructions in the applicable instruction manuals. Shipment of front panel modules in the base chassis voids the warranty.

Packaging for Reshipment, continued

b. Place the receiver and a quantity of desiccant into a moisture-proof polyethylene bag and seal.

c. If the original polystyrene shipping case is available, place the receiver into the case and seal with shipping tape. If the original case is not available, proceed as follows:

1. Place the receiver into a heavy-duty cardboard box using sufficient padding to prevent movement.

2. Seal the carton and place it into a second carton or shipping crate, again using sufficient padding to prevent movement. Seal this carton.

d. Affix the necessary "Fragile" and "Delicate Equipment" labels.

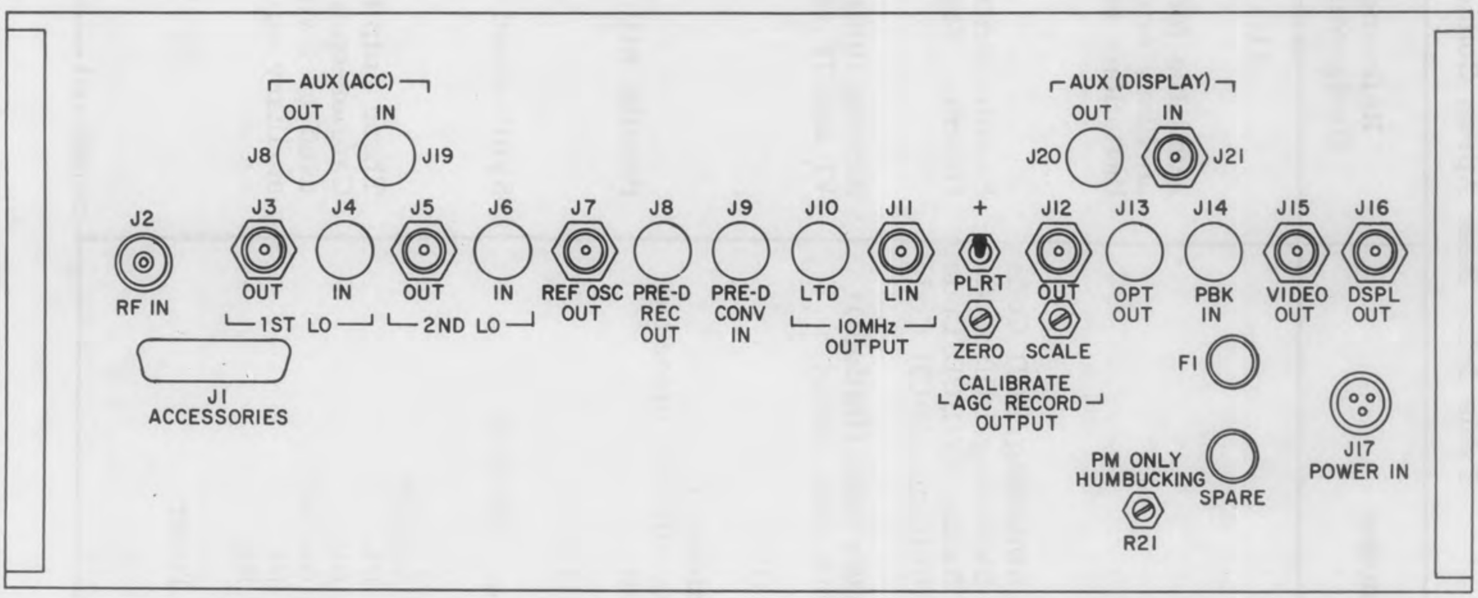


Figure 2-1. Model 1100-AR Telemetry Receiver, Typical Rear View

Table 2-1. Rear Apron Connectors

Connector	Function	Reference Designation	Type	Nominal Level/ Impedance	Recommended Cable
ACCESSORIES		J1	DBM-25S	----	
Pin 1	Ground	Available for monitoring. If desired for driving ancillary equipment, consult factory for current limitations for particular receiver configuration.			24 AWG
Pin 2	+15V DC				24 AWG
Pin 3	+ 6V DC				24 AWG
Pin 4	- 6V DC				24 AWG
Pin 5	-15V DC				24 AWG
Pin 6	Ch. 1 Select Switching/BCD Code	Remote control lines for remote controllable tuners. See tuner manual for details.			24 AWG
Pin 9	Ch. 4 Select Switching/BCD Code				24 AWG
Pin 11	Ch. 2 Select Switching/BCD Code				24 AWG
Pin 15	Ch. 3 Select Switching/BCD Code				24 AWG
Pin 7	RF tuner remote cont.(initiate)+	Remote tuning, + synthesized tuner control line.			24 AWG
Pin 8	IF filter remote cont. input	VI 2nd IF, see filter manual for details.			24 AWG
Pin 10	CFO Monitor Out*				24 AWG
Pin 12	Spare				24 AWG
Pin 13	Lock loop indication, +10V DC lock; -0V DC unlocked				24 AWG
Pin 14	#1 AGC output	Parallel with AGC Record output (J12)			24 AWG
Pin 16	AM Det. DC Out				24 AWG
Pin 17	Spare				24 AWG
Pin 18	Remote Cont. - Advance	Synthesized Tuners			24 AWG
Pin 19	Spare				24 AWG
Pin 20	COR Sect. 1 common	These outputs are connected to the Carrier-operated Relay and may be used as Switching Controls for the ancillary equipment.			24 AWG
Pin 21	COR Sect. 1 NC				24 AWG
Pin 22	COR Sect. 1 NO				24 AWG
Pin 23	COR Sect. 2 common				24 AWG
Pin 24	COR Sect. 2 NC				24 AWG
Pin 25	COR Sect. 2 NO				24 AWG
RF IN	Input to RF Tuner	J2	N	50Ω	RG-223/U or RG-9/U

continued

Table 2-1. Rear Apron Connectors, Continued

Connector	Function	Reference Designation	Type	Nominal Level/ Impedance	Recommended Cable
1st LO OUT	Monitor output of first local oscillator (in RF tuner)	J3	BNC	-13 dBm/50Ω	RG-223/U
1st LO IN*	Input for injecting external signal to be used instead of internally generated first local oscillator signal	J4	BNC	-13 dBm/50Ω	RG-223/U
2nd LO OUT	Monitor output of second local oscillator, 60 (±0.5) MHz	J5	BNC	-13 dBm/50Ω	RG-223/U
2nd LO IN*	Input for injecting external LO in lieu of using the internal LO signal, 60 (±0.5) MHz.	J6	BNC	-13 dBm/50Ω	RG-223/U
REF OSC OUT	Monitor output of calibration/ reference oscillator, 10 MHz	J7	BNC	-20 dBm/50Ω	RG-223/U
PRE-D REC OUT*	Output from record converter A19	J8	BNC	4V p-p/75Ω	RG-59/U
PRE-D CONV IN*	Input to Pre-D converter	J9	BNC	4V p-p/75Ω	RG-223/U
10 MHz OUTPUT LTD*	Output for limited 10 MHz signal from AM detector	J10	BNC	-10 dBm/50Ω	RG-223/U
10 MHz OUTPUT LIN	Output for linear 10 MHz signal from AM detector	J11	BNC	-10 dBm/50Ω	RG-223/U
AGC RECORD OUT	Record output from AGC amplifier	J12	BNC	0-8V/1K load	RG-223/U

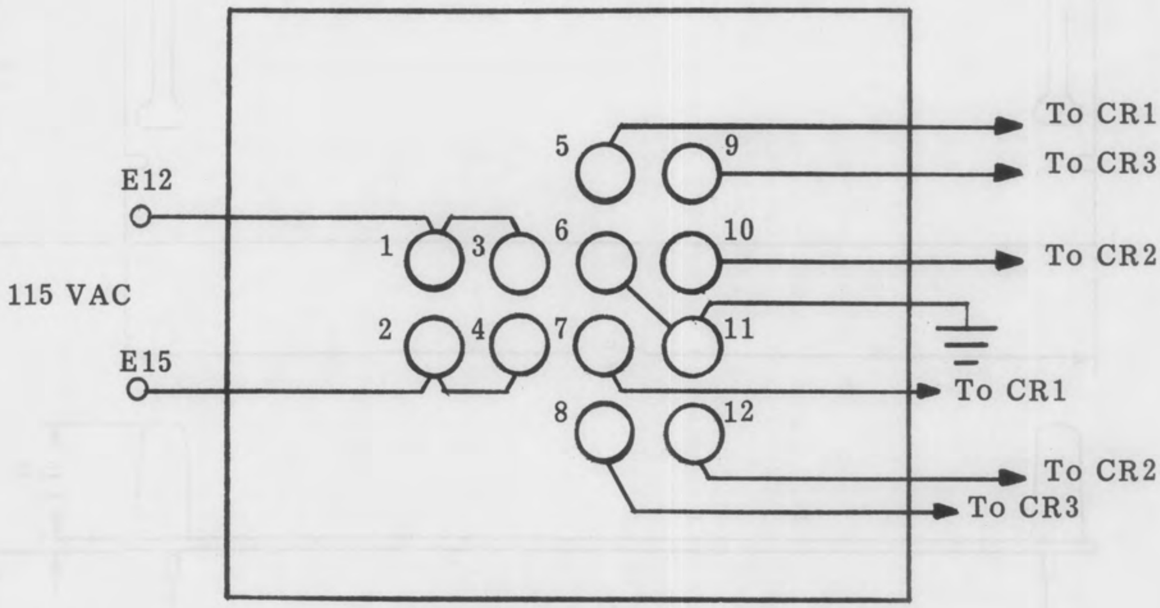
* These connectors are supplied only when specifically required.

continued

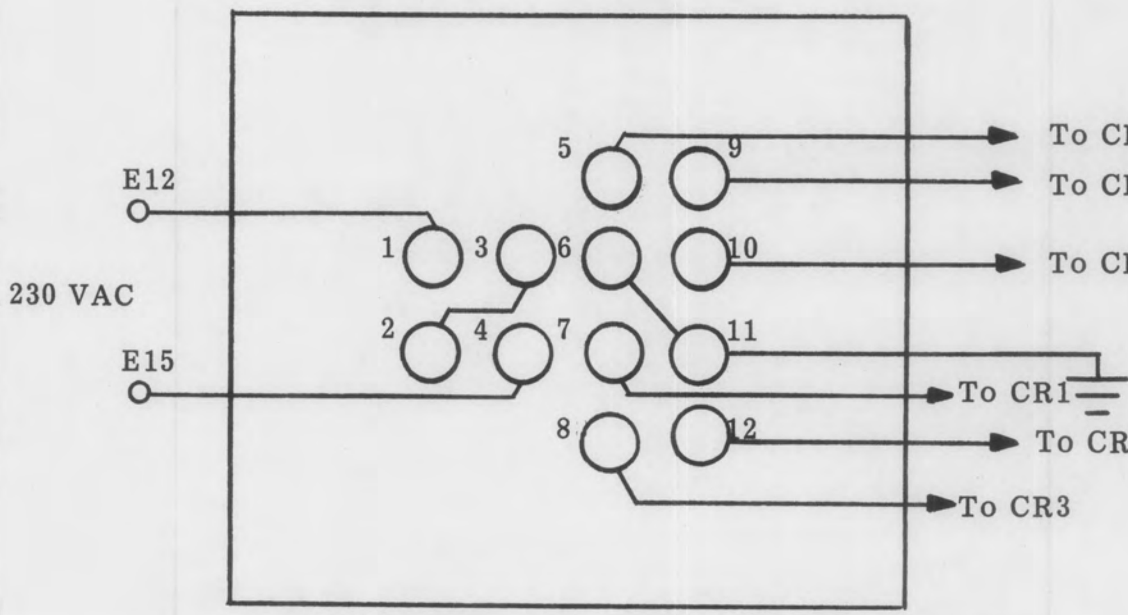
Table 2-1. Rear Apron Connectors, Continued

Connector	Function	Reference Designation	Type	Nominal Level/ Impedance	Recommended Cable
AM DET DC OUT*	High impedance monitor output of AM detector	J13	BNC	----	RG-223/U
PBK IN*	Input to playback converter, A18	J14	BNC	50Ω	RG-59/U
VIDEO OUT	Output for filtered video signals	J15	BNC	10V p-p Max/75Ω	RG-59/U
DISPLAY OUT#	Output (** MHz or 50 MHz) for spectrum display unit	J16	BNC	50Ω	RG-223/U
POWER IN	Input for AC power to receiver; 115/230V AC, 50-400 Hz	J17	MS3102A10 SL-3P	----	18/3 AWG
AUX (ACC) OUT*#	Output from predetection playback (or record) converter A25	J18	BNC	75/50Ω	RG-223/U
AUX (ACC) IN*#	Input to predetection playback (or record) converter A25	J19	BNC	50Ω	RG-223/U
AUX (DISPLAY) OUT*#	Optional coaxial connection to display unit receptacle	J20	BNC	----	RG-223/U
AUX (DISPLAY) IN*#	Input to spectrum display unit, 50 MHz	J21	BNC	50Ω	RG-223/U

* These connectors are supplied only when specifically required.
\# These connectors are supplied on the 7-inch receiver version as required.
** Customer-specified frequency.



A. Strapping - 115 VAC Input



B. Strapping - 230 VAC Input

NOTE: Only the connections to the transformer primary, terminals 1 thru 4, are affected by the conversion from 115V AC to 230V AC or vice versa.

Figure 2-2. Power Transformer Strapping

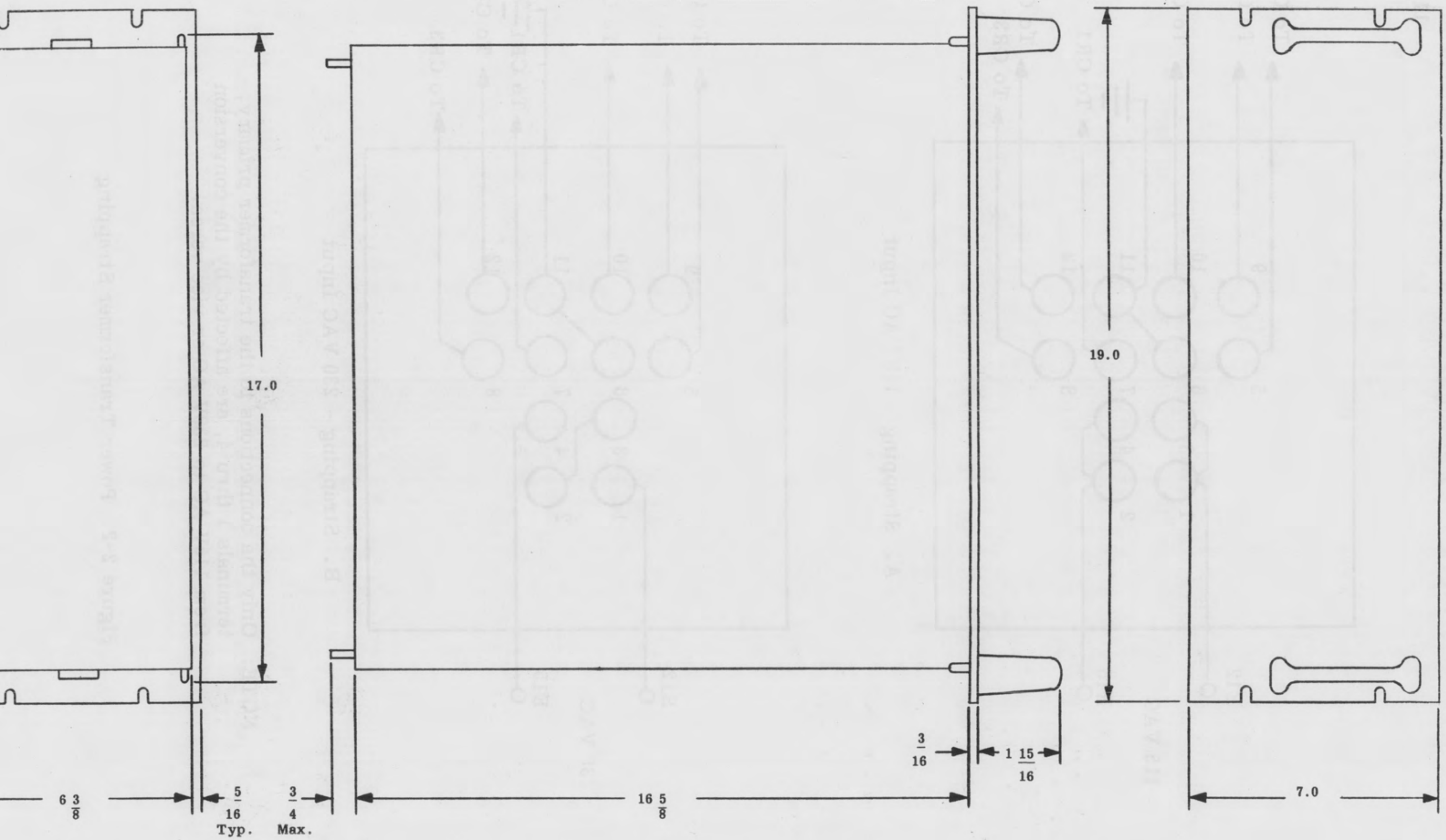


Figure 2-3. Outline Dimensional Diagram

SECTION III
OPERATION

3.1 GENERAL

This section provides operational information for the Model 1100-AR Telemetry Receiver. Included in this section is a list of the operating controls and indicators with their reference designations and functions, operating instructions, and operational information for the various receiver modes. Since the 1100-AR can be configured with many different modules to satisfy specific requirements, to include operating instructions for each configuration would be impractical. For this reason, only general operating instructions are provided. These instructions are, however, augmented by additional information for each operating mode to enable the operator to adjust the receiver controls to meet his specific requirements. Operating procedures for the auxiliary modules which plug into both the 5- and 7-inch versions are given in the applicable instruction manual or booklet supplementing this manual.

3.2 CONTROLS AND INDICATORS

The controls and indicators used in operating the 1100-AR are listed in Table 3-1 with their reference designation and function. This table also includes the controls for a typical complement of front panel plug-in modules. For functional descriptions of the controls on the specific modules in use, consult the applicable instruction manual for the modules.

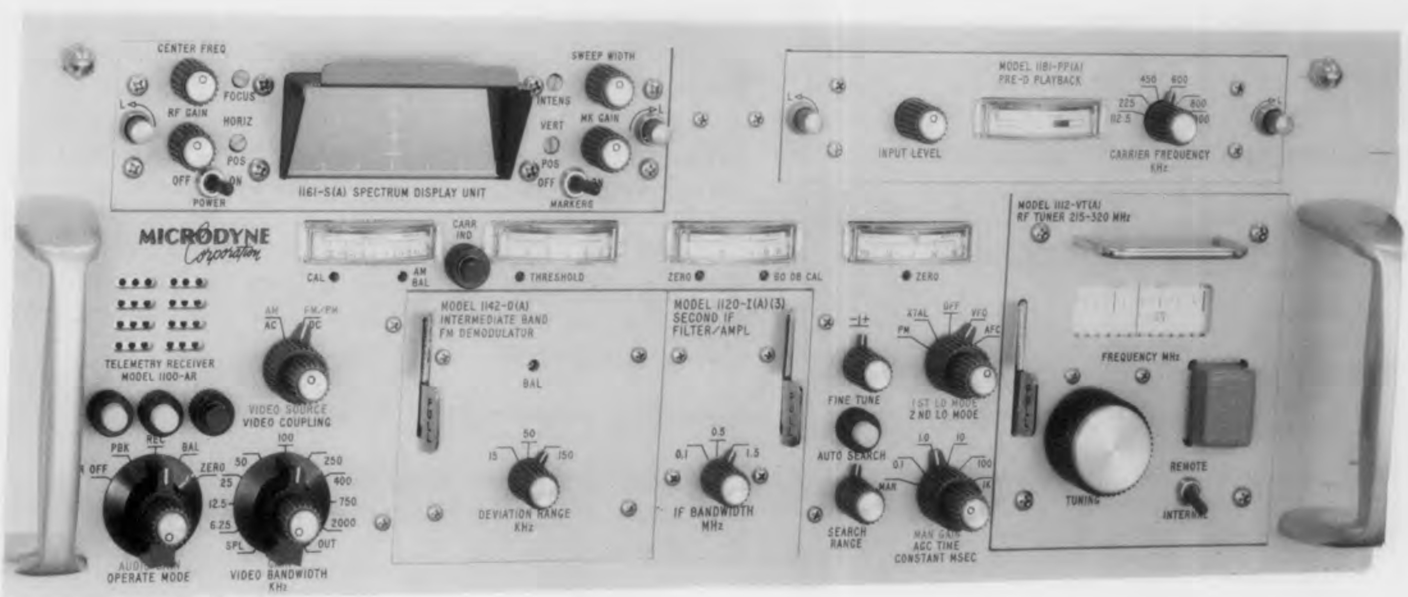


Figure 3-1. Model 1100-AR Telemetry Receiver, Typical Front View

Table 3-1. Controls and Indicators

Control/Indicator	Function
BASE CHASSIS:	
OPERATE MODE switch (S4)	Used to select one of five receiver operating modes: PWR OFF - Removes operating voltage from receiver power supply. PBK - Permits receiver to be used to play back previously recorded data. REC - Normal receiver operation. BAL - Permits the demodulators to be balanced. ZERO - Permits adjustment of tuning meter.
PBK lamp (amber) (DS1) REC lamp (white) (DS2) Calibrate lamp (red) (DS3)	These lamps light when the OPERATE MODE switch is set to the corresponding position.
AUDIO GAIN (R10)	Used to adjust speaker level.
VIDEO SOURCE (A22-S1)	Employed to select either the AM detector (AM) or plug-in demodulator (FM/PM) as the video source.
VIDEO COUPLING switch (A22-S2)	Selects either AC or DC video coupling to the video amplifier.
VIDEO BANDWIDTH KHz (A22-S3)	Selects the video filter cutoff frequency. SPL position is used to select a special video filter installed at customer request. The OUT position bypasses all filtering.
GAIN control (A22-R13)	Sets the video output level.
FINE TUNE control (R6)	Vernier tuning of second local oscillator. Permits ±250 KHz adjustment of second LO frequency.
AUTO SEARCH lamp (amber) (DS5)	Lights when receiver is in auto search operation in AFC and PM modes.

continued

Table 3-1. Controla and Indicators, Continued

Control/Indicator	Function
SEARCH RANGE control (R11)	Permits adjustment of auto search range to ±250 KHz.
1ST LO MODE switch (S1)	Selects the VFO, XTAL, or OFF mode of operation for the first local oscillator located in RF tuner.
2ND LO MODE switch (S2)	Selects the PM, XTAL, OFF, VFO, and AFC operating modes for the second local oscillator.
AGC TIME CONSTANT MSEC switch (S3)	Selects the time constant for the automatic gain control circuit to 0.1, 1, 10, 100 or 1000 milliseconds.
MAN GAIN control (R7)	Used to manually set the gain control of the receiver.
TUNING meter (M1)	Indicates the relative position of the applied signal in the IF passband. It also indicates the loop stress when the receiver is in the AFC or PM mode of operation.
ZERO control (R8)	Used to zero the TUNING meter.
SIGNAL LEVEL dB meter (M4)	Indicates signal level in dB above noise.
60 dB CAL control (R15)	Used to calibrate the 60 dB level on the SIGNAL LEVEL dB meter.
ZERO control (R4)	Used to select the SIGNAL LEVEL dB meter zero point.
DEVIATION KHz meter (M3)	Indicates the carrier deviation in KHz for FM and in degrees for PM.
CARR IND lamp (green) (DS4)	Lights when the applied signal level is above threshold.
THRESHOLD control (R2)	Used to set the level at which the carrier indicator lamp illuminates.
OUTPUT dB meter (M2)	Indicates the video output level in dB.
CAL control (R13)	Used to calibrate the OUTPUT dB meter.
AM BAL (R2)	Adjust video offset when the receiver is in AM operation.

continued

Table 3-1. Controls and Indicators, Continued

HUMBUCKING (R21)	Rear panel control utilized to minimize power line hum on the AFC/APC control line.
FM DEMODULATOR:	
DEVIATION RANGE switch (S1)	Selects the full-scale range of the receiver DEVIATION meter.
BAL control (R1)	Balances the FM video for zero DC output with no input.
RF TUNER (VT SERIES):	
TUNING control	Adjusts the RF tuner for receiving a specific frequency within its operating range.
FREQUENCY KHz	Indicates the frequency to which the receiver is tuned.
INTERNAL/REMOTE	Selects the local or remote tuning mode.
SECOND IF FILTER/AMPLIFIER:	
IF BANDWIDTH KHz	Selects one of the available IF bandwidths.

3.3 OPERATING INSTRUCTIONS

The following paragraphs provide generalized operating instructions for the receiver. These instructions are to be used as a reference as the receiver configuration will depend on the specific mission or requirements.

3.3.1 INITIAL SETUP AND CALIBRATION

Before operating the receiver, the necessary modules should be selected and installed and all rear apron connections checked. The receiver should then be calibrated for the operational mission.

CAUTION

In addition to the calibration procedures herein, the AGC system should be calibrated whenever the second IF filter/amplifier is replaced; see paragraph 5.3.3.1.

Remove power prior to installing or removing any module.

3.3.1.1 FM MODE CALIBRATION

Before starting the calibration, set the front panel controls as follows:

Control	Position
OPERATE MODE	REC
AUDIO GAIN	Mid-Range
VIDEO GAIN	Mid-Range
VIDEO SOURCE	FM/PM
VIDEO COUPLING	AC
1ST and 2ND LO MODE	VFO
AGC TIME CONSTANT MSEC	100
DEVIATION RANGE	Compatible with IF BW
VIDEO BANDWIDTH	As desired

a. Remove the RF tuner, and inject a 50.000 MHz, 50 mV signal into XA3-A3. Place the AFC amplifier on a 300-423 extender card.

b. Set the 2ND LO MODE switch to VFO and adjust the FINE TUNE control for a 10.000 MHz output at J11 on the rear apron.

c. Adjust R22 on the video amplifier module (A14) for 0.0V DC at J15.

d. Set the VIDEO COUPLING switch to DC and adjust the demodulator BAL control for 0.0V DC at J15. Adjust the tuning meter ZERO control to a zero indication on the TUNING meter.

FM Mode Calibration, continued

e. Set the 2ND LO MODE switch to AFC and adjust the balance control on the AFC amplifier for a 10.000 MHz output at J11. (The balance control is R30 on the AFC amplifier.) Also observe that the receiver TUNING meter is on zero.

f. Remove the test signal and replace the tuner.

g. Connect a DC coupled oscilloscope to pin 11 of the extender card.

h. Set the receiver SEARCH RANGE control fully counterclockwise and adjust R37 on the AFC amplifier for a vertical deflection which is symmetrical about zero volts DC.

i. Apply an RF signal to the receiver from an external generator. Set the OPERATE MODE switch to REC. Adjust the RF tuner TUNING control and the FINE TUNE control for a zero tuning meter indication.

j. Set the signal generator attenuator for maximum attenuation.

k. Adjust the ZERO control beneath the SIGNAL LEVEL dB meter for a zero meter indication.

l. Set the signal generator for an output that is 60 dB above noise. This level is determined by the following formula:

$$-174 + NF = IF\ BW/dB + 60\ dB = Input\ Level$$

where: -174 dB = constant

NF = maximum tuner noise figure. See Table 3-3

IF BW/dB = IF bandwidth expressed in dB. See Table 3-2

For example, if the IF bandwidth is 300 KHz and the maximum noise figure is 7 dB, the 60 dB level is calculated as follows:

$$-174 + 7\ dB + 54\ dB + 60\ dB = -53\ dBm$$

m. With the input level set, adjust the signal level meter 60 dB CAL control for a 60 dB meter indication.

n. Decrease the input signal level until the SIGNAL LEVEL dB meter indicates 6 dB. Adjust the THRESHOLD control until the CARR IND (carrier indicator) lamp just lights.

o. Set the VIDEO SOURCE switch to AM and DC coupling. Connect an HP412A DC voltemter to the VIDEO OUT (J15) on the rear apron. Adjust the AM BAL control (under the OUTPUT meter) for a zero volt DC output.

FM Mode Calibration, continued

p. Reset the VIDEO SOURCE switch to FM/PM.

q. Use a Boonton 202J signal generator and a Boonton 207H univerter to produce a 50 MHz signal frequency modulated with a 1700 Hz sine wave.

r. Remove the tuner from the receiver and connect the univerter output to XA3-A3.

s. Adjust the level of the modulation, as necessary, to obtain a carrier deviation equal to 30% of the second IF bandwidth. If the DEVIATION meter indicates other than the correct deviation (ensure that the setting of the demodulator DEVIATION RANGE switch is considered), refer to the booklet applicable to the metering amplifier for maintenance data.

t. Adjust the carrier deviation to the minimum level required to produce rated video output; i.e., 2.0 KHz 1141-D(A), 20 KHz 1142-D(A), 200 KHz 1143-D(A).

u. Connect an RMS voltmeter terminated in 75 ohms to the video output. Adjust the VIDEO GAIN control for a meter indication of 1.414V rms (4V p-p).

v. Set the modulation deviation to the average deviation to be encountered.

w. Set the BAL control for zero on the VIDEO OUTPUT meter.

x. Disconnect all test equipment and replace the RF tuner.

y. If the receiver AGC voltage is to be recorded, the SCALE and ZERO controls on the rear apron must be adjusted for compatability with the input requirements of the recording device. These adjustments are made as follows:

   1. Connect a signal generator to the receiver RF input and set it for an output within the range of the RF tuner.

   2. Tune the receiver to the test signal.

   3. Connect an HP412A DC voltmeter to the AGC RECORD OUT (J12). Set the POLARITY switch to the position corresponding to the required AGC output polarity (+ or -).

   4. Set the signal generator to the minimum RF level to be recorded and adjust the ZERO control for a zero volt indication on the voltmeter.

   5. Set the generator for the highest signal level to be recorded and adjust the SCALE control for the desired output; this may be set up to 12 volts at a -10 dBm RF input level.

   6. Recheck the zero point and adjust the ZERO control, if necessary.

   7. Recheck the maximum point and adjust the SCALE control, if necessary.

   8. Disconnect all test equipment.

3.3.1.2 PM MODE CALIBRATION

When the receiver is equipped with a phase demodulator, the BAL and ZERO positions on the OPERATE MODE switch are inoperable. Functions calibrated are the TUNING meter, SIGNAL LEVEL dB meter, demodulator locking threshold, AM balance and video output. The procedure for calibrating the receiver is as follows:

a. Set the OPERATE MODE switch to REC and allow 30 minutes for stabilization. Set the 2ND LO MODE switch to PM.

b. Set the demodulator SEARCH switch to MANUAL and the VIDEO SOURCE/ COUPLING to FM/PM AC. Set the ANTI-SIDEBAND switch to OUT, if applicable.

c. With no signal input, adjust the LOOP LOCK clockwise until the LOOP LOCK lamp is out.

d. Set the NOISE BAL control for zero on the TUNING meter.

e. Set the SEARCH switch to AUTO and adjust the LOOP LOCK counterclockwise until the AUTO SEARCH lamp begins to flicker. Slowly turn the LOOP LOCK clockwise until the SEARCH lamp is ON; the LOOP LOCK lamp will be out. Set the ANTI-SIDEBAND switch to IN, if applicable.

f. Apply an unmodulated signal to the receiver and lock the loop.

g. Adjust R22 on the video amplifier to 0.0 volts DC at J15.

h. Set the 2ND LO MODE switch to XTAL.

i. Calibrate the zero and 60 dB points of the SIGNAL LEVEL meter as follows:

   1. Set the signal generator for maximum attenuation (-130 dBm max signal) and adjust the ZERO control for a zero indication on the SIGNAL LEVEL meter.

   2. Set the generator for an input signal 60 dB above noise; this level is determined by:

      -174 + NF + IF BW/dB + 60 dB = Input Level

      where: -174 = constant

      NF = max. tuner noise figure. See Table 3-3

      IF BW/dB = IF bandwidth expressed in dB
      See Table 3-2

   3. With the input level set, adjust the 60 dB control for a 60 dB SIGNAL LEVEL meter indication.

j. Set the 2ND LO MODE switch to PM. Ensure the loop is locked.

PM Mode Calibration, continued

k. Calibrate the VIDEO OUTPUT meter to be compatible with mission requirements as follows:

   1. Modulate the carrier with the phase deviation to be encountered.

   2. Set the VIDEO GAIN control for the desired output level (usually 1.414V rms) using a 75 ohm terminated RMS voltmeter at J15.

   3. Set the front panel BAL potentiometer for a zero indication on the VIDEO OUTPUT meter.

l. Remove the modulation.

m. Set the VIDEO SOURCE/VIDEO COUPLING switch to AM/DC and set the VIDEO GAIN control to max (CW). Adjust the AM BAL for 0.0V DC at J15.

n. If receiver AGC (coherent) is to be recorded, adjust the rear panel SCALE and ZERO controls as follows:

   1. Connect a signal to the receiver and lock the phase lock loop.

   2. Connect a DC voltmeter to the AGC RECORD OUT (J12).

   3. Set the POLARITY switch for the desired recording polarity.

   4. Set the signal generator for the minimum signal level to be encountered in the mission.

   5. Adjust the ZERO control for a zero volt level at J12.

   6. Increase the input signal level by 20 dB and adjust the SCALE control for 1 volt at J12. This establishes a 20 dB/volt sensitivity and is typical. Other sensitivity settings can be made to satisfy particular requirements.

   7. Repeat steps 4, 5 and 6, as often as necessary.

   8. Disconnect all test equipment.

Table 3-2. IF Bandwidth in dB

Bandwidth	dB	Bandwidth	dB
10 KHz	40	750 KHz	58
30 KHz	44	1.0 MHz	60
50 KHz	47	1.5 MHz	62
100 KHz	50	2.0 MHz	63
300 KHz	54	3.3 MHz	64
500 KHz	57	6.0 MHz	68

Table 3-3. RF Tuner Noise Figure (Maximum)

Tuner	NF	Tuner	NF
1111-VT(A)	5.5 dB	1116-VT(A)	10.0 dB
1112-VT(A)	7.0 dB	1117-VT(A)	8.5 dB
1113-VT(A)	8.0 dB	1118-VT(A)	8.0 dB
1114-VT(A)	10.0 dB	1119-VT(A)	10.0 dB
1115-VT(A)	10.0 dB		

3.3.2 CONTROL SETTINGS

After checking and calibrating the receiver, set the controls to their initial positions as outlined in the following steps. Controls then may be readjusted, as necessary, for optimum operation following the information given in paragraph 3.3.3.

a. Set the OPERATE MODE switch to REC.

b. Turn the AUDIO GAIN control to mid-range.

c. Set the VIDEO SOURCE switch to FM/PM position. This places the plug-in demodulator into the circuit as the video source. If AM data is to be received, place the switch in the AM position.

d. Set the VIDEO COUPLING switch to AC. Set the VIDEO BANDWIDTH KHz switch to the desired video bandwidth.

e. Set the FINE TUNE and AUTO SEARCH controls to mid-range.

f. Set the 1ST LO MODE switch to VFO. Set the 2ND LO MODE switch to XTAL.

g. Set the AGC TIME CONSTANT MSEC switch to 100 MSEC. If AM data is to be received, set the switch to 1000 MSEC.

h. If the receiver is equipped with a multiple bandwidth second IF filter/amplifier, set the IF BANDWIDTH KHz switch to the widest position.

i. Set the demodulator DEVIATION RANGE KHz switch to widest position.

j. Set the video GAIN control to mid-range.

k. The calibrate/reference oscillator is used to balance the demodulator and the tuning meter. The balance procedure is as follows:

   1. Set the OPERATE MODE switch to BAL and adjust the demodulator BAL control for a zero indication on the TUNING meter.

   2. Set the OPERATE MODE switch to ZERO and adjust the tuning meter ZERO control for a zero indication on the TUNING meter.

l. Set the OPERATE MODE switch to the desired operating mode-REC or PBK.

3.3.3 RECEIVE MODE OPERATION

After the controls have been set to their initial positions as given in paragraph 3.3.2, they should be readjusted for optimum operation. This includes adjustment of the first and second local oscillators, video gain, AGC time constant, search range and audio level.

3.3.3.1 First Local Oscillator

The first local oscillator may be operated in any of three modes: VFO, XTAL and OFF. If the VFO mode is most desirable, set the 1ST LO MODE switch to VFO. Adjust the TUNING control until the desired frequency appears under the dial graticule and the TUNING meter indicates zero. If the XTAL (crystal) mode is selected, adjust the TUNING control until the desired frequency appears under the dial graticule. Insert the necessary crystal into the crystal socket in the tuner front panel using an adapter or oven as required. The formula for determining the correct crystal frequency is given in Table 3-4. The OFF mode is provided to permit the injection of an externally generated LO signal. Refer to the tuner manual for additional information.

3.3.3.2 Second Local Oscillator

With an FM demodulator, the second local oscillator may be operated in the crystal (XTAL), external input (OFF), VFO, or AFC mode as determined by the position of the 2ND LO MODE switch; a PM mode is also available for use in phase mode operation. (See paragraph 3.3.4.)

a. XTAL (Crystal) mode As in the case of the first local oscillator, no tuning of the second local oscillator is required when operated in the crystal mode. In this mode, the reception of a signal is indicated by the lighting of the CARR IND lamp and by a zero indication on the TUNING meter.

b. VFO mode When operated in the VFO mode, the second local oscillator is tuned by adjusting its FINE TUNE control until the CARR IND lamp lights and there is a zero indication on the TUNING meter. The 2ND LO MODE switch should then be set to the AFC position to maintain proper tuning.

Table 3-4. Crystal Determining Formulas

RF Tuner	Formula	RF Tuner	Formula
1111-VT(A)	$\frac{F_r + 50}{6}$	1116-T(A) 1116-VT(A)	$\frac{F_r + 50}{42}$
1112-VT(A)	$\frac{F_r + 50}{8}$	1117-T(A)	$\frac{F_r + 50^*}{8}$ $\frac{F_r + 50^{**}}{12}$
1113-VT(A)	$\frac{F_r + 50}{4}$	1118-VT(A)	$\frac{F_r + 50}{4}$
1114-T(A) 1114-VT(A)	$\frac{F_r + 50}{36}$	1119-T(A) 1119-VT(A)	$\frac{F_r + 50}{24}$
1115-T(A) 1115-VT(A)	$\frac{F_r + 50}{54}$		

where: F_r = received frequency

50 = intermediate frequency

* Used with input frequencies from 215 to 290 MHz

** Used with input frequencies from 290 to 410 MHz

Second Local Oscillator, continued

c. AFC mode The 2ND LO MODE switch should be initially set to AFC only when automatic search tuning of the oscillator is desired. In this position, a control signal from the receiver AFC amplifier causes the oscillator frequencies to be swept back and forth as indicated on the TUNING meter and by the lighting of the AUTO SEARCH lamp. The center of the frequency swept by the oscillator may be varied by adjusting the FINE TUNE control. The range swept by the oscillator may be varied ±250 KHz around the center frequency by adjusting the SEARCH RANGE control. When a signal is acquired in the channel, the AUTO SEARCH lamp goes out, the CARR IND lamp lights, and the TUNING meter shows steady indication. The meter may be indicating other than zero since it is controlled by the AFC loop stress voltage. If other than zero, adjust the FINE TUNE control to obtain a zero indication. This method of tuning is automatic and proper tuning is maintained until no carrier is detected or until the control limit of the AFC circuit is exceeded.

d. External Input (OFF) mode This mode is used when slaving two or more receivers together. The 2ND LO MODE switch is set to the OFF position and the 60 MHz external signal injected into J6 of a level of approximately -10 dBm.

3.3.3.3 Video Gain

Adjust the VIDEO GAIN control for the output level desired as indicated on the VIDEO OUTPUT meter.

3.3.3.4 AGC Time Constant

The AGC time constant is selected by the AGC TIME CONSTANT MSEC switch. With this switch in the MAN position, the receiver gain is adjusted by means of the MAN GAIN control. The proper setting of switch depends upon the characteristics of the carrier and the type of format being received. Unless another setting is required for proper signal demodulation, the AGC TIME CONSTANT MSEC switch should be left in the 100 position.

3.3.4 PM MODE OPERATION

Two signal search (acquisition) modes are available in PM operation: manual and automatic. The procedure for adjusting the receiver controls in each mode is given in paragraphs 3.3.4.2 and 3.3.4.3 and should be used in conjunction with the instructions given in paragraph 3.3.2. Prior to operating the receiver in the PM mode, carefully read the operating precautions in the following paragraph.

3.3.4.1 PM Mode Operating Precautions

When operating an 1100-AR receiver with any 1150-Series Phase Demodulator, the following precautions should be observed and implemented to obtain satisfactory receiver operation.

a. Operate the first local oscillator only in the XTAL mode.

PM Mode Operating Precautions, continued

b. Calibrate the HUMBUCKING potentiometer on the receiver rear panel using the following procedure. Normally, this adjustment is only required when setting up the receiver for the first time. It should be checked at least semi-annually and when the power line frequency has changed.

1. Apply a strong, stable, CW signal to the receiver.
2. Tune the receiver to the signal and phase lock using the 30 Hz loop bandwidth.
3. Connect an oscilloscope to the receiver video output (J15); terminate the connection in 75 ohms.
4. Adjust the HUMBUCKING control on the rear panel for minimum hum on the video output.
5. Disconnect the test equipment.

c. After warming up the receiver for a period of 30 minutes, the BAL controls on the phase demodulator may be normalized using the following procedure:

1. Install the demodulator into the receiver.
2. Set the OPERATE MODE switch to REC and the LOOP BANDWIDTH Hz switch to 300 Hz.
3. Set the demodulator SEARCH switch to MANUAL. Set the ANTI-SIDEBAND switch to OUT, if applicable.
4. With no signal input to the receiver, adjust the LOCK BAL control counter-clockwise until the LOOP LOCK lamp is out, if necessary.
5. Adjust the NOISE BAL control for a zero indication on the applicable receiver TUNING meter.
6. Set the SEARCH switch to AUTO and adjust the LOCK BAL control counter-clockwise until the applicable receiver AUTO SEARCH lamp begins to flicker.
7. Slowly turn the LOCK BAL clockwise until the AUTO SEARCH lamp is constantly on; the LOOP LOCK lamp will be out.
8. Rotate the LOCK BAL one full turn past the point at which the AUTO SEARCH lamp remains lit.
9. Optimize the N BAL control setting by injecting a 1 mV CW test signal into the receiver at frequency within the range of the tuner and phase lock. Set the generator for an output which will produce a -15 dB S/N ratio in the second IF and adjust the N BAL control until the LOOP LOCK lamp is just locking on the signal. The level required can be calculated as:

   -174 + IF BW/dB + NF -15 = Negative SNR in the IF for phase lock

   when: -174 = Constant
   IF BW/dB = IF bandwidth in dB; see Table 3-2
   NF = RF tuner noise figure; see Table 3-3 or perform actual measurement

PM Mode Operating Precautions, continued

d. The phase lock loop in the 1100-AR is an adaptive loop and is restricted as to the minimum modulation frequencies that can be handled at the various loop bandwidths. For unattenuated sine wave and accurate square wave video outputs, the minimum modulating frequencies at each loop bandwidth are listed below:

Loop Bandwidth Hz	10	30	100	300	1000
MIN. Sine Wave Frequency	70 Hz	210 Hz	700 Hz	2100 Hz	5000 Hz
MIN. Square Wave Frequency	350 Hz	1000 Hz	3500 Hz	10 KHz	25 KHz

3.3.4.2 Manual Search

a. Set the 1ST LO MODE switch to XTAL. Adjust the TUNING control to the desired frequency and insert the required crystal (see Table 3-4). Set the 2ND LO MODE switch to PM.

b. Set the demodulator SEARCH switch to MANUAL and the LOOP BANDWIDTH Hz switch to 1000.

c. Hold the LOOP switch in the OPEN position and adjust the demodulator FINE TUNE control for an aural zero beat tone from the speaker. The LOOP LOCK lamp should light. Release the switch.

d. Slowly adjust the demodulator FINE TUNE control to minimize the static phase error as indicated by a zeroing of the TUNING meter.

e. Reduce the loop bandwidth to the desired range.

f. Set the receiver video controls as required.

3.3.4.3 Automatic Search

a. Set the 1ST LO MODE switch to XTAL. Adjust the TUNING control to the desired frequency and insert the required crystal. (See Table 3-4.) Set the 2ND LO MODE switch to PM. Set the ANTI-SIDEBAND switch to OUT, if supplied.

b. Set the demodulator LOOP BANDWIDTH Hz switch to 1000. Set the demodulator FINE TUNE control to 5.

c. Set the SEARCH switch to AUTO. The LOOP LOCK lamp should light, indicating phase lock.

d. Adjust the demodulator FINE TUNE control to minimize the static phase error as indicated by a zeroing of the TUNING meter.

e. Reduce the loop bandwidth to the desired range.

f. Set the receiver video controls as required.

Automatic Search, continued

g. If the demodulator is equipped with an anti-sideband lock circuit, place the ANTI-SIDEBAND switch to ON. This will effectively prevent sideband locks during reacquisition cycles.

3.3.5 PLAYBACK MODE OPERATION

Set the controls and apply power to the receiver (refer to paragraphs 3.3.2 and 3.3.3). Set the OPERATE MODE switch to PBK; this disables the first LO and effectively removes the RF tuner as an active module in the receiver. If the receiver is equipped with a PM demodulator, adjust the receiver controls as directed in paragraph 3.3.4. Set the video output level of the receiver as directed in paragraph 3.3.3.3

3.3.6 COMPUTER/REMOTE CONTROL

The "VT" series of tuners permits remote tuning and/or crystal channel selection depending on tuner model. The "VT" series of second IF filter/amplifiers permits remote tuning of the bandwidth within the operational range of the module. To operate the receiver in the remote or computer-controlled mode, proceed as follows:

a. Refer to the applicable RF tuner and/or IF amplifier instruction manuals to ensure that the remote panel or computer interface is capable of supplying the correct range of control or switching voltages.

b. Consult the RF tuner and IF amplifier instruction manuals and Table 2-1 herein for cable connections to the accessories connector J1.

c. Set all receiver controls to the positions required by the operating mission excluding the RF frequency and IF bandwidth (refer to paragraph 3.3.2).

d. Refer to the tuner, IF filter/amplifier and remote control device instruction manuals for additional operational information, such as local control settings, etc.

3.3.7 AGC RECORDING

If the receiver AGC voltage is to be recorded, the SCALE and ZERO controls on the rear panel must be adjusted for compatibility with the input requirements of the recording device. These adjustments are made as follows:

a. Connect a signal generator to the receiver RF input and set it for an output within the range of the RF tuner.

b. Tune the receiver to the test signal.

c. Connect an HP412A DC voltmeter to the AGC RECORD OUT (J12). Set the POLARITY switch to the position corresponding to the required AGC output polarity (+ or -).

d. Set the signal generator to the minimum RF level to be recorded and adjust the ZERO control for a zero volt indication on the voltmeter.

AGC Recording, continued

e. Increase the signal generator output by 20 dB and adjust the SCALE control for 1 volt. This sets a 20 dB/volt scale.

f. Recheck the zero point and adjust the ZERO control, if necessary.

g. Recheck the 20 dB point and adjust the SCALE control, if necessary.

h. Disconnect all test equipment and connect the receiver for normal operation.

3.4 TURN-OFF PROCEDURE

To turn the receiver off, set the OPERATE MODE switch to the OFF position.

SECTION IV
THEORY OF OPERATION

4.1 GENERAL

This section discusses the theory of operation for the 1100-AR receiver on a system level only. The theory of operation is based on the block diagram shown in Figure 4-1 and is divided into the various signal paths. In addition, descriptions of the various control circuits are discussed separately and are supplied by the necessary block diagrams.

4.2 PRIMARY SIGNAL PATHS

The primary signal paths of the 1100-AR are: normal signal flow, predetection signal flow and control signal flow.

4.2.1 NORMAL SIGNAL FLOW

The normal signal path of the 1100-AR consists of the circuits which accept and process the RF signal. See Figure 4-1.

The antenna input is made to J2 on the rear apron and coupled to the RF tuner module installed in receptacle A3. Two types of RF tuners may be installed in A3: mechanically tuned and voltage controlled. Both types function to down convert the applied RF signal to a 50 MHz first IF signal by mixing it with a local oscillator frequency. The local oscillator input may be generated by switch selectable internal variable frequency or crystal-controlled oscillators, or by an external source connected to J4. The external source can be a frequency synthesizer or another receiver and enables a group of receivers to be slaved together. Selection of which local oscillator source is used is made through front panel switch S1. The voltage-controlled RF tuners have the additional capability of being tuned by an input from a remote panel or computer interface. When operated in this mode, the control voltage is applied to the tuner via J1-7 and XA3-6.

Outputs from the tuner are applied to the rear apron first LO monitor output J3 and to the first IF filter module receptacle XA4. The signal applied to J3 is submultiple of the local oscillator signal and is at a level of approximately 50 mV; the impedance of this output port is 50 ohms. The signal applied to the first IF filter slot is the 50 MHz first IF signal and is routed through the internal wiring to XA4-A1.

The use of a first IF filter is optional. The first IF filters are utilized to provide steep-skirted filtering to the 50 MHz output of the tuner. Four standard single bandwidth filters establishing first IF bandwidths of 600 KHz, 1.2 MHz, 4.0 MHz and 6.0 MHz are available. A two bandwidth switchable filter establishes IF bandwidths of 1.2 MHz or 4.0 MHz depending on the second IF filter/amplifier in use. Selection of the first IF bandwidth is automatic by the choice of the second IF filter/amplifier, which connects a combination of +15V and -15V to pins 9 and 10 of the filter receptacle to control a diode switching network. Both filter types contain an integral 50 MHz buffer amplifier which provides a 50 MHz output for display purposes.

Normal Signal Flow, continued

The display options are illustrated in the functional block diagram. In the standard configuration, the 50 MHz display output of the first IF filter is made available at J16 on the rear apron. If the receiver (1100-AR) employs a spectrum display unit, J16 is jumpered to J21 using a 50 ohm coaxial cable, which routes the 50 MHz display signal to the spectrum display receptacle at XA23-A1. If the display subsystem requires a display signal other than 50 MHz, an optional display converter is installed in slot A20. The 50 MHz display output of the first IF filter is routed through the SDU converter to J16. Should the system require dual display outputs, an SDU buffer (A28) is employed.

Each of the first IF filter modules supplies a 50 MHz output at XA4-A2 for application to the second mixer at XA6-A3. If the receiver does not use a first IF filter, the output of the tuner is routed directly to the second mixer via a jumper across XA4-A1 and XA4-A2. The second mixer accepts both the 50 MHz IF signal from either the first IF filter or the tuner and the 60 MHz input from the second local oscillator A5, and provides a 10 MHz second IF output. This signal is made available at XA6-A7 and is routed to the input of the second IF filter installed in XA7. The gain of the second mixer is controlled by AGC voltage applied to pin 7.

Second IF filter/amplifier A7 establishes the second IF bandwidth. Any of three types of modules can be installed in A7: fixed single bandwidth, multi-bandwidth switchable, or voltage variable. The multi-bandwidth units contain any two or three of the single bandwidth types in a module housing equipped with a front panel selector switch. The voltage tuned units enable the selection of any bandwidth in their range and are supplied with a calibrated dial. These units have the additional capability of being tuned by a remote or computer input.

AGC circuits in each filter have a control range in excess of 60 dB to hold the 10 MHz output level to approximately -21 dBm. Total gain of each IF filter/amplifier varies in proportion to the bandwidth to maintain a constant noise density to the AM detector.

The AM detector module consists of an AM detector circuit, a limiter circuit and various amplifier stages. The 10 MHz IF signal from the second IF filter amplifier output at XA7-A1 is applied to XA8-A4 and routed to the three main circuits of the module. Signals applied to the detector circuit are demodulated to provide AM video data and an output to the AGC amplifier. The AM video signal is taken from XA8-A2 and routed through XA9-29 and XA9-32 to the front panel video source switch A22-S1. When A22-S1 is set to AM, the AM video is applied to the video amplifier module. The output to the AGC amplifier is taken from XA8-15 and routed through the plug-in demodulator to the AGC amplifier at XA15-F. A third detector output is taken from XA8-13 and applied to rear apron connector J13 (option) as an indication of the detector DC level.

The limiter and amplifier stages of the AM detector provide limited and linear 10 MHz outputs for predetection recording purposes. These signals are taken from XA8-A3 and A1, and routed to J10 and J11 on the receiver rear apron. A third 10 MHz output is taken from XA8-A5 and applied to the plug-in demodulator at XA9-A4.

Two types of demodulators may be installed in the 1100-AR: FM or PM. When the receiver is equipped with an FM demodulator, the 10 MHz IF signal is applied to XA9-A4.

Normal Signal Flow, continued

This signal is then demodulated to retrieve the FM video data which is taken from XA9-A2 and applied to the video source switch A22-S1. The FM demodulator also supplies an output at XA9-25 for driving the deviation meter via the metering amplifier. Tuning meter drive voltage is provided at XA9-23. Another output from the demodulator is taken from XA9-26. This output is the product of a mean-of-peaks detector and is further processed by the AFC amplifier into automatic frequency control voltages and tuning meter drive voltage when the second LO is in the AFC mode of operation. The AGC voltage from the AM detector is also routed through the demodulator via pins 13, 14 and 15. This interface is necessary to allow coherent AGC operation when a PM demodulator is employed.

When the receiver is equipped with a PM demodulator, the 10 MHz IF signal is compared to a 10 MHz reference signal supplied by calibrate/reference oscillator A10. The result of this comparison is PM video data which is taken from XA9-A2 and coupled to the video source switch A22-S1. The PM demodulator also supplies an output for controlling the phase of the second LO. This voltage is taken from XA9-A3 and applied to the second LO via the AFC module. When PM demodulator is used, the receiver fine tuning control R6 is disabled and the demodulator fine tuning control is placed into the circuit.

The video data from either the plug-in demodulator or AM detector is taken from the video source switch (A22-S1) and applied to the video bandwidth selector switch A22-S3. From A22-S3, the video signal is routed through the selected video filter and the video coupling switch (A22-S2) to the input of video amplifier at XA14-2. The input level to the amplifier is set by front panel video gain control A22-R13. A more complete description of the video filters is given in paragraph 4.2.5.

The video amplifier module contains two separate amplifier circuits. One amplifier accepts the video input and supplies a video output to rear apron connector J15. This output may be at any level up to 10 volts peak-to-peak and is adjusted by gain control A22-R13. A second output is also provided by this amplifier to drive front panel output meter M2. This signal is taken from XA14-5 and applied to M2 via the front panel output calibrate control A21-R13.

The second amplifier stage is the audio amplifier. The input to this stage is the video signal before filtering and is supplied from A22-S3A to XA14-14 via front panel audio gain control R10. The signal is amplified and applied to front panel speaker LS1 from pins 8, 9 and 10 of XA14.

4.2.2 PREDETECTION SIGNAL FLOW

The predetection signal path is divided into two distinct and separate circuits. These two circuits designated predetection record and predetection playback are described separately in the following paragraphs.

4.2.2.1 PREDETECTION RECORD CIRCUIT

The 10 MHz predetection record signal can be processed using either of two methods in the 1100-AR and by one method in the 1100-AR(5) to obtain a video carrier signal suitable for recording. As shown in the receiver block diagram (Figure 4-1), both receiver configurations can be equipped with the 10-1100 series record converters.

Predetection Record Circuit, continued

The 10-1100 series converter will accept either a 10 MHz linear or 10 MHz limited second IF signal and provide a single video record output. The 10-1100 record converter is installed in receptacle XA19. The 10 MHz IF signal, available at rear apron connector J10 (10 MHz limited) or connector J11 (10 MHz linear) is patched into XA19-A1 via J9 also on the rear apron. The video record carrier signal is taken from XA19-A3 and is made available at J8. Input and output impedances are 50 ohms and 75 ohms, respectively, to satisfy interface requirements. The standard 10-1100 series converters and their respective output video record frequencies are listed below.

10-1100 (112.5)	- 112.5 KHz	10-1100 (900)	- 900 KHz
10-1100 (225)	- 225 KHz	10-1100 (600)	- 600 KHz
10-1100 (450)	- 450 KHz	10-1100 (800)	- 800 KHz

In addition to the above, other converters may be supplied to satisfy a particular requirement.

The second method of down conversion for recording is available in the 1100-AR configuration only. This method employs either the Model 1171-PR(A) or 1172-PR(A) Predetection Record Converter which mounts in auxiliary equipment slot XA25. When either converter is used, any one of six video carriers can be selected through a front panel selector switch. The 1171-PR(A) and the 1172-PR(A) differ in the video carrier frequencies provided. Input to the converter can be supplied by either the linear or limited 10 MHz second IF signal available at J10 or J11 via J19 and XA25-A1. The output of the converter is taken from XA25-A3 and routed to rear apron connector J18. Input and output impedances are also 50 and 75 ohms. respectively, to satisfy interface requirements. Additional information on the 1171-PR(A) and the 1172-PR(A) is given in their respective instruction manuals.

Block Diagram Notes:

1) - - - - - - Optional Modules.
2) Shaded blocks indicate front panel modules.
3) A23 Spectrum Display Unit, A25 Record Converter, and A25 Playback Converter available only in 7-inch receivers.
4) A20 SDU Converter employed to convert the 50 MHz IF to a customer specified frequency compatible with other vendor spectrum display units.
5) A4 First IF Filter - if not used, the output of the tuner is jumpered directly to second mixer.
6) Standard internal modules shown. Exceptions are the 45-1100 and 44-1100 options.
7) See text for description of Spectrum Display, Pre-D Record, and Pre-D Playback options.
8) The function and use of optional connectors depend on customer's needs and on the optional features incorporated in receivers. Connectors shown in parentheses () are secondary assignments, other connectors may be used for these functions if the primary assignments are utilized; those with * are optional connectors. See receiver configuration, page b.

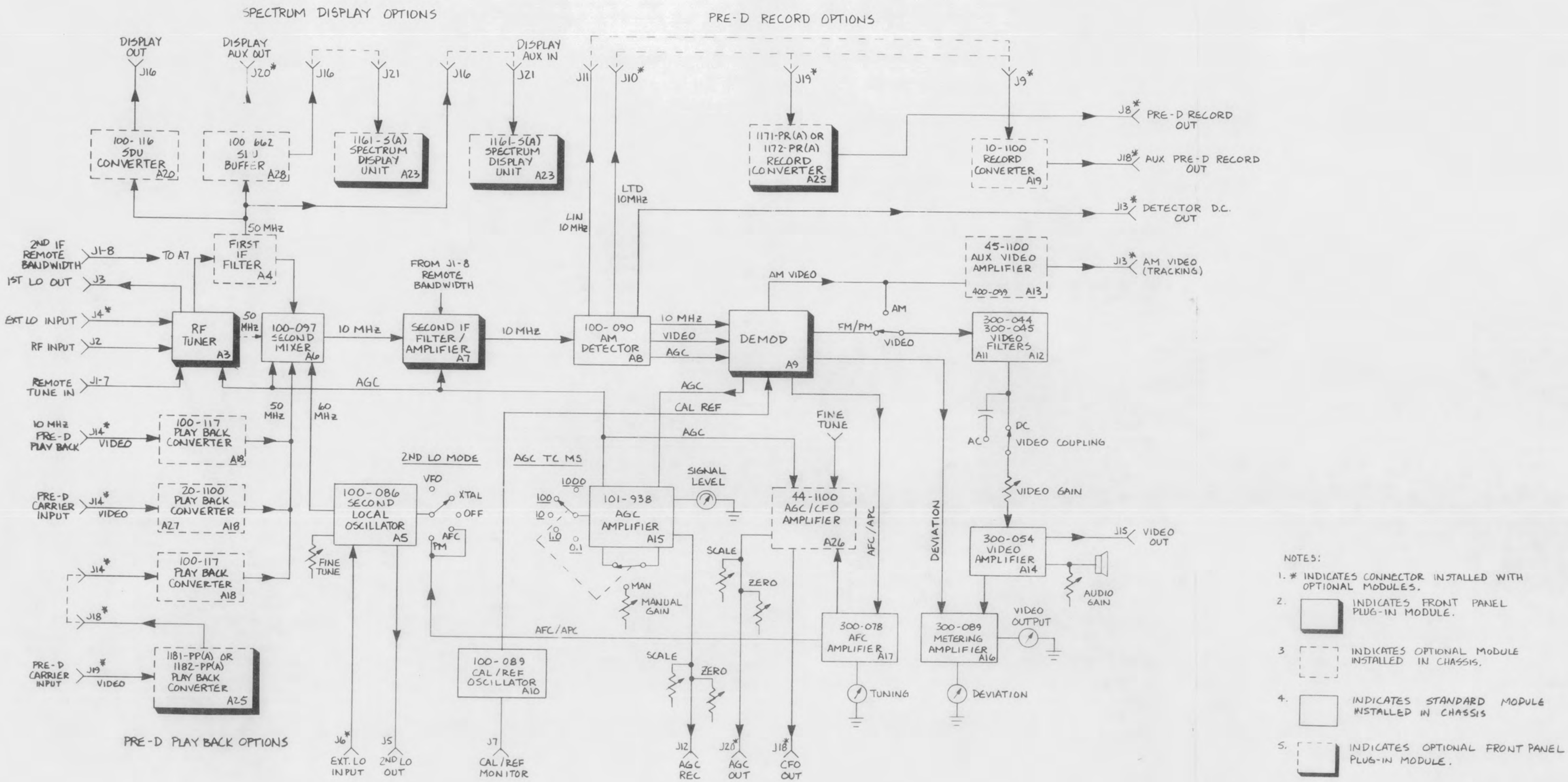


Figure 4-1. 1100-AR Block Diagram (403-406)

4.2.2.2 PREDETECTION PLAYBACK CIRCUIT

As shown by the block diagram in Figure 4-1, three methods of playback up conversion are available depending on the receiver configuration.

The first option of up conversion employs the 20-1100 series of playback converters. This dual module consists of a 6.8 MHz to 50 MHz up converter A27, and a video carrier to 6.8 MHz up converter A18. The 20-1100 playback converter will process a single video carrier whose frequency depends on the selection of the video up converter. Video up converters are available for processing any one of the following video frequencies: 112.5 KHz, 225 KHz, 450 KHz, 600 KHz, 800 KHz or 900 KHz (standard).

The video carrier from the recording device is applied to J14 on the rear apron and connected to the video up converter at XA27-A1. This signal is converted to 6.8 MHz and applied to the 6.8 MHz up converter via XA27-A3 and XA18-A3. The 50 MHz output present at XA18-A1 is then coupled to the second mixer at XA6-A5.

The second option of up conversion employs the 100-117 and the 1181-PP(A) or 1182-PP(A) up converters. Both of these assemblies can be mounted in the 1100-AR. When employed in the 1100-AR, the 1181-PP(A)/1182-PP(A) is installed in the upper right front panel equipment slot and plugs into XA25 and the 100-117 converter is installed in XA18. These two units operate in conjunction to up convert any of six video carriers to 50 MHz for injection into the first IF signal path.

The video signal from the recording device is applied to J19 on the receiver rear apron and connected to the 1181-PP(A) via XA25-A1. A front panel switch on the 1181-PP(A) and 1182-PP(A) is provided to select the appropriate video carrier frequency. The 1181-PP(A) and the 1182-PP(A) differ in the video carrier frequencies accommodated. The output frequency of the 1181-PP(A)/1182-PP(A) is 10 MHz and is made available at J18 via XA25-A3. This signal is then patched to the 100-117 up converter via J14 and XA18-A1. In the 100-117, the 10 MHz signal is up converted to 50 MHz and is applied to the second mixer at XA6-A5 from XA18-A3.

When the 1181-PP(A)/1182-PP(A) and 100-117 are used with the 1100-AR(5), the 1181-PP(A) and 1182-PP(A) is mounted externally to the receiver and the 100-117 is mounted in the receiver. The 10 MHz output of the 1181-PP(A)/1182-PP(A) is connected to J14 on the receiver rear apron and applied to the 100-117 for up conversion to 50 MHz. The input and output impedances of the 1181-PP(A)/1182-PP(A) are 75 and 50 ohms, respectively, and the input and output impedances for the 100-117 are 50 ohms.

The third option of up conversion accepts a 10 MHz predetection playback signal for conversion to 50 MHz. This option employs only the 100-117 playback converter. The 10 MHz predetection signal is applied via J14 to the 100-117 where it is converted to 50 MHz and routed to the second mixer.

4.2.3 CONTROL SIGNAL FLOW

The control signals in the 1100-AR provide automatic gain control and either automatic frequency or phase control depending on the demodulator is use. Each control system is described separately in the following paragraphs.

4.2.3.1 AUTOMATIC FREQUENCY CONTROL (AFC) SYSTEM

The AFC system is operable when the receiver is equipped with an FM demodulator.

The AFC system, shown in Figure 4-2, generates an AFC voltage and a search voltage to sweep the second LO for reacquisition should signal fade cause loss of lock. When the receiver is locked to an input, the AGC voltage from the AM detector and the COR input is holding the acquisition amplifier on. The output from this amplifier turns on one of the two FET switches coupling the input from the demodulator mean-of-peaks detector to the integrator. In the locked state, the integrator functions as an operational amplifier which amplifies the demodulator input and couples it to the second LO for frequency control and to the tuning meter as an indication of loop stress. Should the frequency drift exceed the AFC loop limits as set by capacitor C and drop lock, the AFC system automatically switches to the search cycle. Under these conditions, the voltage from the AM detector goes positive and turns off the acquisition amplifier and turns on the other FET switch connecting the retrace amplifier across the integrator and lighting the front panel sweep indicator lamp. The integrator now generates a ramp output used to sweep the second LO over its tuning range. The maximum amplitude of the ramp is determined by the positioning of the front panel search range control R11 now in the feedback loop. Using R11, the search range can be adjusted from ±50 to ±250 KHz. When a 10 MHz signal appears in the IF passband, the output from the AM detector triggers the acquisition amplifier on removing the sweep and returning the AFC system to the tracking mode.

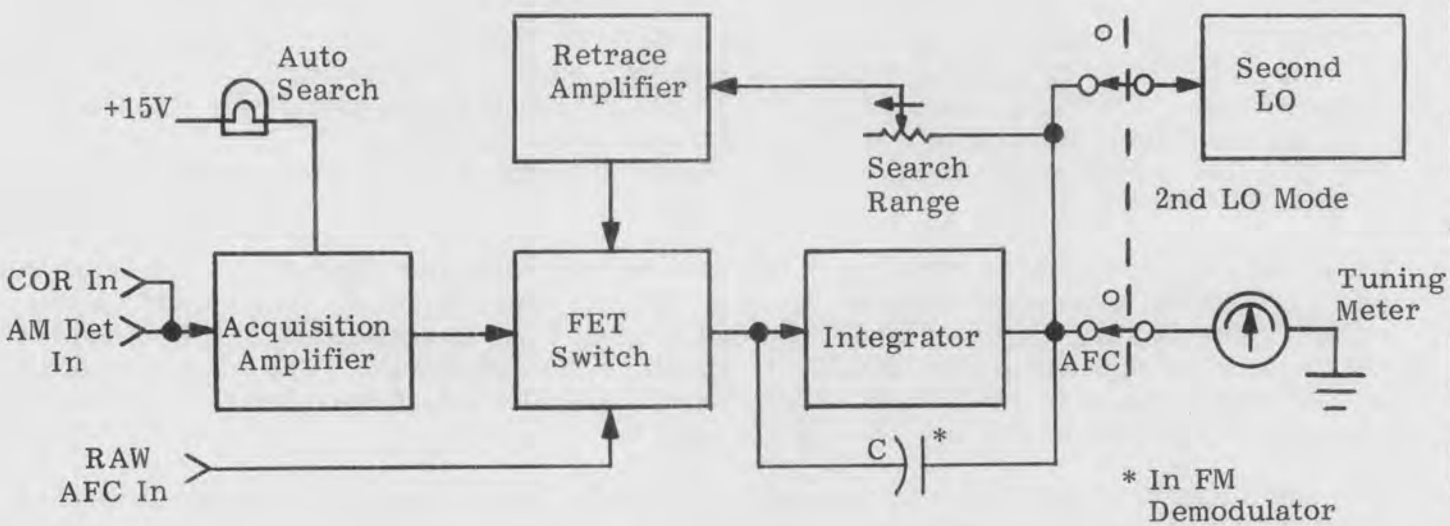


Figure 4-2. AFC Circuit, Simplified Schematic

4.2.3.2 AUTOMATIC PHASE CONTROL (APC) SYSTEM

The following description is of the circuitry employed in the Model 1151-D(B) Demodulator; the circuitry in the other module PM demodulators differ slightly. The APC system in the 1100-AR is operable only when the receiver is equipped with a PM demodulator and the second LO mode switch is set to PM. The system is composed of the AFC and retrace amplifiers in the AFC module (A17) and the APC board in the PM demodulator. Additionally, the system operating mode and the RC networks for determining the loop bandwidth are also contained in the PM demodulator. When the receiver is set for APC operation, the

Automatic Phase Control (APC) System, continued

normal receiver fine tune control is replaced by the demodulator fine tuning control. During this mode, the APC system not only maintains the correct phase relationship between the second LO and received signals, but will also search a range of frequencies determined by loop bandwidth should phase lock be broken. A simplified block diagram of the APC system is shown in Figure 4-3.

The APC system in the 1100-AR permits two signal acquisition modes: automatic and manual. When set to the automatic mode and phase locked as shown in Figure 4-3, the output of the phase detector in the PM demodulator is applied to the AFC amplifier module via demodulator loop open/close switch S3A and the demodulator loop bandwidth switch S1A. The RC network composed of resistors and capacitors mounted on demodulator switch S1 along with the AFC amplifier compose the loop filter for the phase lock loop. Time constants are provided by S1 to establish loop bandwidths as shown on demodulator front panel. The output of the AFC amplifier is then applied to the second local oscillator for frequency control purposes and to the receiver tuning meter for loop stress indications.

When the demodulator is phase locked, the +13V gate holds FET switch A4Q1 off, and holds A4Q2, A4Q3 and A2Q2 on. In this configuration, the video output of the phase detector circuit is coupled through S3A and R/S1A to the AFC amplifier in the parent unit. The AFC amplifier is configured as an operational integrator with a response time determined by the RC network associated with S1A, S1B and S1C. Output from the amplifier is routed to the second local oscillator for frequency control purposes and to the tuning meter as an indication of loop stress.

When phase lock is broken, the -13V gate turns on FET A4Q1 and turns off A4Q2, A4Q3 and A2Q2. In this configuration, the output of integrator (A4U1) is coupled to the AFC retrace amplifier via S1D. Since A2Q2 is off, the AFC amplifier gain is reduced to approximately 0.67. Also, the integrator A4U1 is enabled and generates a ramp output to the second LO via the AFC amplifier. The level of the ramp at the AFC amplifier output ranges from approximately 1V peak-to-peak to approximately 13.3V peak-to-peak depending on the positioning of the demodulator loop bandwidth switch S1 sections D and E. The demodulator fine tune control sets the sweep center frequency ±250 KHz from 60 MHz. See demodulator manual for sweep rates and widths which are programmed by the loop bandwidth switch setting. During the sweep cycle, the search indicator lamp on the parent unit is illuminated by the action of a switching circuit in the AFC amplifier module. When a 10 MHz signal appears in the IF passband, the output of the demodulator synchronous AM detector causes the gate to switch to +13V. This causes FET switch A4Q1 to be turned off, and switches A4Q2, A4Q3 and A2Q2 to be turned on. In this mode, the integrator is disabled and AFC amplifier resumes control as an infinite gain operational amplifier. The +13V gate also turns on the demodulator lock lamp while the AFC amplifier turns off the search lamp.

If the receiver is equipped with a demodulator having an anti-sideband circuit, the +13V gate is inhibited except when the unit is within the self-acquisition range of the loop. This action then prevents the disabling of the sweep circuit and the illumination of the lock lamp. The sweep action will continue until such a time that the input signal is recognized as the carrier. When this occurs, the 13V gate switches to its positive sense, thus disabling the sweep and illuminating the lock lamp.

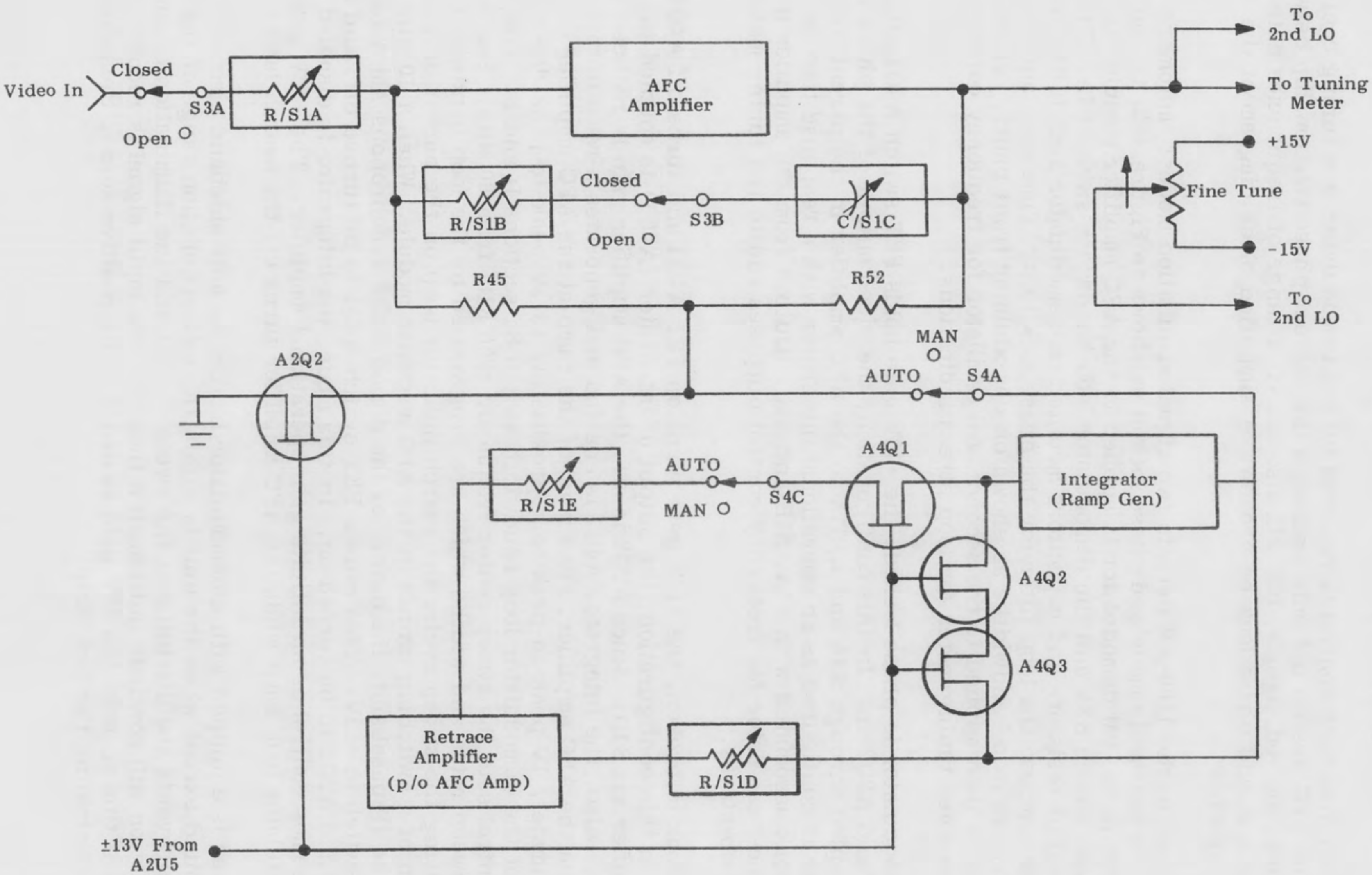


Figure 4-3. Sweep Circuitry, Block Diagram

4.2.3.3 AUTOMATIC GAIN CONTROL (AGC) SYSTEM

The automatic gain control system in the 1100-AR supplies either non-coherent or coherent AGC voltages depending on the type of demodulator installed. With an FM demodulator installed, only non-coherent AGC voltages, which are a function of the carrier envelope, are generated. When a PM demodulator is used, both coherent and non-coherent voltages may be generated depending on whether or not the receiver is phase locked. If the receiver is phase locked, coherent AGC is supplied by the PM demodulator and is a function of the phase modulation amplitude. Using this type of gain control, the dynamic range of the receiver is increased by approximately 15 dB. Should phase lock be broken, non-coherent AGC is supplied by the AM detector via the demodulator. A simplified block diagram of the AGC system is shown in Figure 4-4.

The AGC system has two modes of operation: automatic and manual. In the automatic mode, voltage from the AFC source (AM detector or demodulator) is applied to the AGC module at XA15-F. The signal is coupled to an integrator whose response time is determined by the positioning of front panel time constant switch S3. This switch configures an RC network in the integrator feedback loop to provide response times of 0.1, 1.0, 10, 100 and 1000 milliseconds. The output of the integrator is taken from XA15-N and coupled to the RF tuner, second mixer, and second IF filter/amplifier to effectively control the gain of the receiver.

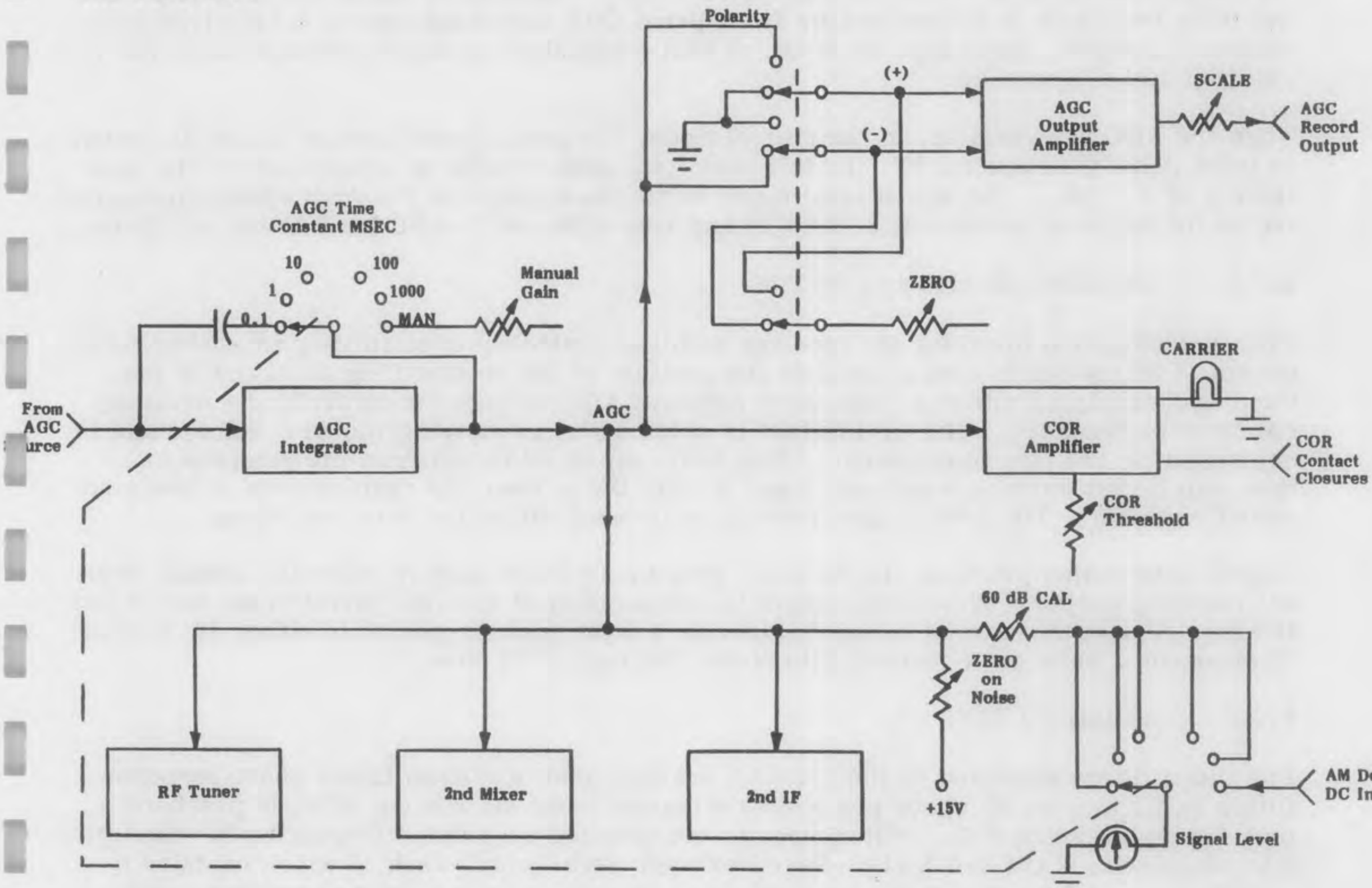


Figure 4-4. AGC System, Simplified Block Diagram

Automatic Gain Control (AGC) System, continued

Another output is taken from XA15-14 and applied to signal level meter M4. This voltage is applied to M4 via front panel 60 dB calibrate control R15. The zero point on the meter is set by front panel control R4 which is adjusted to supply a bucking voltage at XA15-M to cancel any input to the AGC amplifier resulting from noise.

Outputs from the integrator are also supplied to an AGC output amplifier and a COR amplifier also located in the AGC module. The signal applied to the output amplifier is routed through rear panel polarity switch S4. When S4 is placed in the positive position, the negative AGC signal from the integrator is inverted to a positive signal and applied to rear apron output J12. When S4 is placed to the negative position, the AGC signal is simply amplified and coupled to J12. Rear panel controls R10 and R11 are employed to adjust the scale and zero of the AGC record output for optimum operation with external recording devices and signal combiners.

The AGC signal applied to the COR amplifier is employed to energize the carrier operated relay and to turn on the front panel carrier indicator lamp DS4. When there is an input to the amplifier, the relay is energized, providing contact closure indications at rear apron accessories connector J1. At the same time, a transistor is turned on to complete the signal path for turning on the carrier indicator lamp. The level at which the lamp is lit and the relay energized is determined by front panel COR threshold control R2 electrically connected to XA15-P. Normally, R2 is set so that a signal at +6 dB IF SNR will cause the COR amplifier to be turned on.

When the AGC system is set to the manual mode, the gain control voltage source is switched to front panel gain control R7. In this mode, the gain voltage is determined by the positioning of R7 only. The signal level meter is disconnected from the AGC system and connected to the AM detector module at XA8-10 and now indicates the DC level at the AM detector.

4.2.4 OPTIONS 44-1100 and 45-1100

The 44-1100 option provides the receiver with the capability of supplying an analog voltage output (CFO) which is proportional to the position of the received signal in the IF passband and supplying either a positive or negative AGC voltage for controlling a diversity combiner or recorder. The CFO output is obtained by processing the AFC voltage and is controlled by the fine tune control. The AGC output, obtained from the receiver AGC line, can be set anywhere between 0 and 8 volts DC to meet the requirements of the associated combiner. The AGC output polarity is determined by the internal wiring.

The 45-1100 option provides the receiver with an AM video output which is suitable as an AM tracking output. This video output is independent of the AM-FM/PM video switch positioning. The option can be set up to provide 4 volts peak-to-peak into either 50 ohms or 75 ohms, or 2 volts peak-to-peak into either 50 ohms or 75 ohms.

4.2.5 VIDEO FILTERS

The video filters employed in the 1100-AR are two-pole, maximum linear phase response filters exhibiting 24 dB above per octave attenuation for signals out of their passband (see Figures 7-5 and 7-6). Filter circuits are mounted on printed circuit cards which plug into receptacles XA11 and XA12. Seven printed circuit cards each of which contains a specific group of filter circuits are available. Normally, the receiver is equipped with video filter card 1 and any one of the remaining six cards depending on the customer's requirements. The seven video filter cards and the frequencies are:

Video Filters, continued

Video Filter #1 - 6.25 KHz, 12.5 KHz, 25 KHz, 100 KHz
Video Filter #2 - 250 KHz, 400 KHz, 750 KHz, 2 MHz
Video Filter #3 - 250 KHz, 500 KHz, 1000 KHz, 1500 KHz
Video Filter #4 - 300 KHz, 500 KHz, 750 KHz, 1000 KHz
Video Filter #5 - 250 KHz, 500 KHz, 750 KHz, 1000 KHz, 1500 KHz
Video Filter #6 - 250 KHz, 400 KHz, 750 KHz, 1000 KHz, 1500 KHz
Video Filter #7 - 300 KHz, 500 KHz, 750 KHz, 1000 KHz, 1500 KHz
Video Filter #8 - 250 KHz, 500 KHz, 1000 KHz, 1500 KHz, 2000 KHz
Video Filter #9 - 12.5 KHz, 25 KHz, 50 KHz, 100 KHz, 250 KHz
Video Filter #10- 500 KHz, 750 KHz, 1000 KHz, 2000 KHz

Additionally, should a special filter be required, that filter is installed in receptacle XA13.

Video data from the demodulator or the AM detector, as selected by video source switch A22-S1, is coupled to the video bandwidth switch A22-S3A (see Figure 7-3, sheet 5). This switch is employed to connect the video signal to one of the filter cards or to bypass all filters. The signal is taken from A22-S3B and routed through video gain control R13 and video coupling switch A22-S2 to the input of the video amplifier XA14-2 or XA14-3.

4.2.6 POWER SUPPLY

The power supply circuit of the 1100-AR provides the ±15V and ±6V DC operating voltages and the heater voltage for the crystal ovens in the RF tuners. Additionally, in the 1100-AR, a current regulator is included to compensate for the increased current requirements when a signal display unit is installed. The power supply is composed of the main supply circuitry mounted on the chassis, and two plug-in voltage regulators. Refer to the instruction booklets for the regulators for circuit descriptions.

Power supply components are: line filter FL1, power switch S4 on the front panel, diode rectifiers CR1 and CR2, +15V regulator Q1, +6V regulator Q2, -15V regulator Q3, -6V regulator Q4, heater supply Q5, +5V supply for digital display tuners and the display regulator. Primary power of 115V AC or 230V AC is applied to J17 and is coupled to power transformer T1 through FL1 and power switch S4. In T1, the primary input is stepped down to provide outputs to rectifiers CR1 and CR2. The positive output of CR1 (approximately +30V DC) is applied to the display and positive regulating circuitry composed of Q1-Q2-A1 with filtering provided by C1. The negative output of CR1 (approximately -30V DC) is applied to the negative regulating and heater supply composed of Q3-Q4-A2 and Q5. Filtering of the negative voltage is accomplished by C2. Rectifier CR2 is utilized to supply positive and negative 70V DC to the voltage-controlled tuner and second IF filter/amplifier when installed.

The positive regulator consists of series regulators Q1 and Q2. These two transistors operate in conjunction with voltage regulator A1 to provide +15 and +6V operating voltages to the receiver circuitry. The +15V output is taken from the collector of Q1 and the +6V output is taken from the collector of Q2. A more detailed description of the operation of Q1 and Q2 is given in the instruction booklet for the regulators provided as a supplement to this manual.

Power Supply, continued

The positive output is also applied to display regulator A24 (see Figures 7-2 and 7-7). This circuit functions to supply the positive operating voltage to the display unit when installed in the 1100-AR and is necessary to compensate for the resultant high turn-on current. Positive 15 volts from Q1 is employed as a reference level and the input is supplied from the positive output of CR1. The module consists of series regulator Q4, voltage amplifiers Q2 and Q3, and current limiter Q1. Regulator Q4 and the two amplifiers function in a closed control loop to maintain a +15.7V output to the display unit. Should the output vary, the difference between it and the +15V reference is amplified by Q2 and Q3, and applied to the base of Q4 as bias. This effectively increases or decreases the conduction of Q4 raising or lowering the output as necessary. Should the drain on the regulator cause more than approximately 0.7V to be dropped across the input resistors (R1-R6), current limiter Q1 is turned on. With Q1 turned on, Q4 cuts off to return the output to its normal level. The current limiter cuts off the regulator should the output current exceed approximately 700 mA.

The negative output of CR2 is applied to the negative regulator circuitry Q3-Q4-A2. This circuit functions in the same manner as the positive circuit with -15V taken from the collector of Q3 and -6V taken from the collector of Q4.

Negative voltage from CR1 is also applied to oven heater supply Q5. This transistor operates in a similar manner to the series regulators. Control signals are generated within the metering amplifier (A16) and applied to the base of Q5.

The +5V supply for driving the digital display on the 1100-D series RF tuners consists of bridge rectifier CR3 and voltage regulator U1. This supply makes available 5V DC, 1 amp, at pin 11 of the tuner receptacle and is used to energize the digital displays when the D series tuners are employed in the receiver.

SECTION V
MAINTENANCE

5.1 GENERAL

This section contains information pertaining to the maintenance of the 1100-AR Telemetry Receiver. Included herein are a list of required test equipment and the preventive and corrective maintenance instructions.

The receiver is serviced on two levels: a) on the equipment level where the maintenance tasks are performed on the overall receiver, considering the modules and subassemblies as replaceable parts; and b) on the module level where the individual modules are independently serviced. The maintenance tasks in this section are limited to those pertaining to the overall receiver and thus the:

1. Preventive maintenance procedures are limited to those recommended for the overall receiver.

2. Troubleshooting data is that required for fault isolation to the module level, and

3. Alignment/adjustments are limited to the required interface calibration.

The instruction booklets for the modules should be consulted for maintenance data on the module circuitry.

If a low mean time to repair is required, it is recommended that a set of spare modules be maintained. If a fault occurs in a module, it can be replaced with a spare and the receiver returned quickly to operation. The defective module can then be repaired as time permits and maintained as the spare.

The test equipment required to maintain the 1100-AR (less the front panel modules) is listed in Table 5-2. Equivalent equipment may be used where applicable. Due to the various front panel modules that may be used in the receiver, it is impractical to list the test equipment requirements for these units herein. Test equipment requirements for the front panel modules are listed in the instruction manuals for same.

The design of the 1100-AR eliminates the need for special test equipment. To permit the testing and troubleshooting of the modules in the receiver, test cables and extender modules/cards are required. These are listed on the following page.

5.2 PREVENTIVE MAINTENANCE

Preventive maintenance for the 1100-AR consists of a visual inspection and a performance test. The performance test delineates the minimum acceptable standards for proper receiver operation.

Table 5-1. Test Cables/Modules

Component	Part Number
Extender Module	300-355
Extender Module	300-356
Extender Card	300-423
Tuner Test Cables	200-452, 200-453
Demodulator Test Cable	200-493
IF Filter/Amplifier Test Cable	200-494
IF Filter/Amplifier Test Cable	201-147 (Voltage Tuned Modules)
Extender Cable, Spectrum Display Record and Playback Converters	201-713
*Test Cable (2)	200-729

Table 5-2. Recommended Test Equipment**

Signal Generator/Univerter	Boonton 202J/207H
Signal Generator	HP608E
Signal Generator	HP606A or B
Oscilloscope	HP180A/1801A/1820A
Digital Voltmeter	Fluke 8000A
Noise Figure Meter (modified for 10 MHz input)	HP342A
Noise Sources	HP343A, HP349A
Sweep Generator	Texscan VS-80
Test Oscillator	HP652A
Frequency Counter	HP5245L/5253B
RF Sampling Voltmeter	HP3406A
RF Detector	HP8471A
Dual Power Supply	HP6205B
Distortion Analyzer	HP334B
AC Voltmeter	HP3400A
Spectrum Analyzer	HP8551B
VSWR Kit	Telonic TRK-2A
50 Ohm Termination	HP908A

5.2.1 VISUAL INSPECTION

A visual inspection of the receiver should be performed at monthly intervals to prevent possible malfunctions caused by a mechanical fault or failure. The inspection should include, but is not limited to, the following checks:

a. Rear apron connectors for corrosion, looseness and damaged or loose contacts.
b. Internal wiring for cut, cracked, frayed insulation and nuts and bolts for looseness.

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* Not required - but recommended to facilitate access to inputs/outputs of module receptacles
** Base Chassis and internal modules

Visual Inspection, continued

c. Solder joints for crystallization and corrosion.
d. Switches and internal connectors for loose connections and corrosion.
e. Resistors and wiring for discoloration and other evidence of overheating.
f. Dust and dirt accumulation. If dusty, blow out the receiver chassis using low pressure air.
g. Front panel for scratches and bare spots.

All loose hardware should be tightened immediately. Damaged and corroded switches and connectors should be replaced. Overheated resistors and wiring should be replaced only after determining the cause of overheating. Scratches and bare spots on the front panel should be covered using a matching touchup paint.

5.2.2 LUBRICATION

Lubrication of components within the receiver is not required.

5.2.3 PERFORMANCE TESTS

The following tests should be performed at six-month intervals to ensure proper receiver operation. Prior to beginning the tests, the receiver should be calibrated following the procedures given in Section III.

CAUTION

Remove power before installing or removing any module.

5.2.3.1 POWER SUPPLY CALIBRATION/TEST

The power supply calibration involves adjustments on the positive voltage regulator A1 and the negative voltage regulator A2. The subassemblies do not require extraction from the base unit; the potentiometers are physically located on top edge of the board to permit easy access. Use caution in making these adjustments.

Required Test Equipment: Digital Voltmeter, Oscilloscope

a. Apply power to the receiver and allow a fifteen-minute warm-up period.
b. Monitor the voltages on the appropriate pins of the accessories connector J1 and, if necessary, adjust the associated control for the correct voltage as listed below:

J1 Pin No.	Adjustment	Voltage
2	A1R9	+15.0V, ±5.0 mV
3	A1R12	+ 6.0V, ±2.0 mV
5	A2R9	-15.0V, ±5.0 mV
4	A2R12	- 6.0V, ±2.0 mV

c. Connect the voltmeter to the +5V DC line in the receiver. The voltage should be +5.0, ±0.2V DC.

Power Supply Calibration/Test, continued

d. Monitor each of the above voltages using an oscilloscope - AC coupled - and observe no greater ripple than 5 mV p-p.

e. Measure the voltage at pin 16 of the tuner connector XA3. This voltage should be -70 to -80 volts DC.

f. Measure the voltage present on pin 6 of the tuner connector XA3. It should be +70 to +80 volts DC.

g. Terminate pin 7 of XA23 to ground with a 30 ohm, 15 watt resistor bank and measure the voltage under load. This voltage should be +15.60V DC, ±0.150V DC. Remove the resistor load.

This completes the power supply calibration and test.

5.2.3.2 FM TESTS

Install an FM demodulator into the receiver and set the front panel controls as follows:

OPERATE MODE	REC
1ST LO MODE	XTAL
2ND LO MODE	XTAL
DEVIATION RANGE	Maximum
VIDEO SOURCE/COUPLING	AM/AC
VIDEO BANDWIDTH KHz	6.25
AGC TIME CONSTANT MSEC	100
SEARCH RANGE	Fully Counter-clockwise
VIDEO GAIN	Fully Counter-clockwise
AUDIO GAIN	Mid-Range

a. NOISE FIGURE
The following test ensures that the 1100-AR meets noise figure requirements. Test equipment required for this test consists of an HP342A noise figure meter and either an HP343A VHF noise source or an HP349A UHF noise source depending on the frequency range of the RF tuner.

1. Connect the noise source to the noise figure meter and to the receiver RF input.

2. Connect the receiver LIN 10 MHz OUTPUT (J11) to the noise meter input. Calibrate the noise equipment.

3. Set the 1ST LO MODE switch to VFO and tune the receiver over its range. Note that the noise level does not exceed the maximum level specified for the tuner installed. The tuners available for use with the 1100-AR and their maximum noise figure are listed in Table 3-3.

4. Set the 1ST LO MODE switch to XTAL. Insert a crystal into the front panel socket and adjust the TUNING control for the corresponding dial frequency. Observe that the noise figure does not exceed the maximum level as previously noted.

5. Repeat step 4 using crystals at the high, low and middle portions of the tuning range.

6. Disconnect all test equipment.

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FM Tests, continued

b. AGC RANGE
This test is to ensure that the AGC circuit maintains the IF signal level within a 3 dB range at the demodulator input. Test equipment required consists of an HP3406A RF voltmeter and a signal generator compatible with the tuner frequency range.

1. Connect the signal generator to the receiver RF input. Connect the LIN 10 MHz OUTPUT (J11) to the input of the HP3406A RF voltmeter.
2. Set the 1ST LO MODE to XTAL.
3. Insert a mid-band crystal into the tuner socket. Set the generator output to approximately -60 dBm and tune it to the receiver.
4. Vary the input level from -100 dBm to -7 dBm and observe that the voltmeter indication varies less than 3 dB.
5. Vary input level from 0 dB SNR_{IF} to -7 dBm and again note that the voltmeter indication varies less than 3 dB. The starting level is determined by the following formula using the figures given in Tables 3-2 and 3-3.

$$-174 + \text{IF BW/dB} + \text{NF} = 0 \text{ dB } SNR_{IF}$$

where: IF BW/dB = the IF bandwidth expressed in dB. See Table 3-2.

NF = maximum RF tuner noise figure. See Table 3-3.

For example, using an IF bandwidth of 300 KHz and an 1115-T(A) tuner, threshold is:

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$$-174 + 54 + 10 = -110 \text{ dB}$$

6. If the receiver is equipped with a multi-bandwidth filter, repeat step 5 for each bandwidth.
7. Disconnect all test equipment.

c. AFC RANGE
This test demonstrates the AFC system tracking range and drift reduction factor. Required test equipment consists of an HP5245L counter equipped with an HP5453B or HP5254B converter, a second HP5245L counter, and a signal generator compatible with the RF tuner frequency range.

1. Connect the counter and converter to the signal generator uncalibrated output. Connect the second counter to the LIN 10 MHz OUTPUT (J11).
2. Connect the signal generator calibrated output to the receiver input.
3. Set the 2ND LO MODE switch to VFO and tune the receiver to the input signal. Adjust the FINE TUNE control for a 10 MHz indication on the counter.
4. Set the 2ND LO MODE switch to AFC.

AFC Range, continued

5. Slowly vary the input signal frequency ±250 KHz. Record the 10 MHz counter indications at the ±250 KHz limits.
6. Calculate the drift reduction by dividing the change of the 10 MHz IF signal into 500,000. The reduction should be greater than 5,000.
7. Disconnect the test equipment.

5.2.3.3 PM TESTS

Install a PM demodulator into the receiver and set the front panel control as follows:

OPERATE MODE	REC
1ST LO MODE	XTAL
2ND LO MODE	PM
LOOP BANDWIDTH	1000
VIDEO SOURCE/COUPLING	FM/PM-AC
VIDEO BANDWIDTH	6.25 KHz
AGC TIME CONSTANT MSEC	100
SEARCH RANGE	Fully counter-clockwise
VIDEO GAIN	Fully counter-clockwise
AUDIO GAIN	Mid-Range

a. PHASE LOCK

This test ensures that the locking threshold of the receiver is within specifications. Test equipment required consists of a signal generator and a 10 dB attenuator.

1. Connect the output of the signal generator to the receiver RF input through the 10 dB attenuator, locating the attenuator directly at the receiver input jack.
2. Set the generator output level to -90 dBm and lock the receiver to the signal.
3. Vary the input level from threshold to -7 dBm and note that the receiver remains phase locked over the entire range. Threshold is defined by the following formula:

   $-174 + \text{IF BW/dB} + \text{NF} - 15 = \text{Threshold}$

   where: -174 = constant; -15 = Negative SNR_{IF} for Lock

   IF BW/dB = IF bandwidth expressed in dB. See Table 3-2.

   NF = maximum tuner noise figure. See Table 3-3.

   For example, with an IF bandwidth of 750 KHz and a tuner noise figure of 10 dB, threshold is:

   $-174 + 58 + 10 - 15 = -121$ dBm

4. Disconnect the test equipment.

PM Tests, continued

b. PHASE DEMODULATOR
The following test demonstrates that the receiver is capable of demodulating a signal with up to 150° of phase deviation. Test equipment required is:

Signal Generator	Boonton 202J
Univerter	Boonton 207H
Oscillator	HP651B
Spectrum Analyzer	HP8551A/HP8552A
Distortion Analyzer	HP334A

1. Connect the 202J to the 207H and adjust for an output of 50 MHz.
2. Connect the HP651B to the FM input of the 202J. Set the HP651B to 5 KHz.
3. Connect the 207H output, at 50 mV, to the spectrum analyzer input.
4. Set the output of the HP651B to 1.38 on the 3 volt scale of the 651B meter.
5. Adjust the FM MOD control on the 202J for a carrier null as observed on the analyzer. The 202J/207H configuration is now calibrated for 138° of PM and the first carrier null.
6. Adjust the HP651B output level to zero.
7. Disconnect the HP651B from the 202J. Disconnect the 207H from the analyzer.
8. Remove the tuner from the receiver and connect the output of the 207H to A3 of the receiver tuner receptacle through a 10 dB pad. Lock the receiver to the signal and adjust the FINE TUNE control for a zero tuning meter indication.
9. Connect the HP334A distortion analyzer, terminated in 75 ohms, to the receiver video output (J14). Set for voltmeter operation.
10. Reconnect the HP651B to the 202J and increase its output to 1.50 (150°).
11. Set the VIDEO BANDWIDTH KHZ switch to 25 and adjust the VIDEO GAIN control for a meter indication of 2.5V RMS.
12. Reset the HP334A for distortion measurement and check the distortion; it should be less than 3%.
13. Disconnect all test equipment.

5.3 CORRECTIVE MAINTENANCE

The corrective maintenance for the 1100-AR consists of troubleshooting, repair and replacement, and realignment. Information pertaining to these subjects is given in paragraphs 5.3.1, 5.3.2 and 5.3.3. Corrective maintenance sequence should be:

1. Isolation of the fault.
2. Replacement/Repair of the defective modules/part.
3. Realignment of the repaired module, if applicable.
4. Performance check of receiver.

5.3.1 TROUBLESHOOTING

Troubleshooting requirements for the 1100-AR consist of the steps and procedures necessary to isolate the problem to a defective plug-in module or to the base unit and power supply. Voltage measurements should be used to check out the power supply; also consult the instruction booklet for the regulators.

The nominal levels for the receiver outputs are given in Table 2-1. These levels, in conjunction with the functional block diagram, should enable the isolation of the fault to a module or particular group of modules and the switching/wiring thereto. Use the block diagram to determine which modules are common to the recognized symptoms. The suspected modules can then be checked by substitution, if spares are available, or by monitoring their input/output characteristics under operating conditions. Table 5-3 provides reference data for the standard modules. The meter indications and the effect the controls have or do not have should also be used as a troubleshooting guide. For example, with a known input, there is no video or audio outputs, but the signal level, tuning, and deviation meters are operating normally, the logical area to start troubleshooting would be at the video source switch A22S1. This is indicated by recognizing that all meters except the output meter are functioning normally and that only the video and audio outputs are absent.

The output of the module under test can be monitored at the signal termination point on the following module receptacle. For example, the IF output of the tuner may be checked at A1 of XA4 (first IF filter receptacle). The module must be removed to permit access to the receptacle. The 200-729 test cable may be used to gain access to the receptacle pins. Consult the receiver wiring diagram to identify the signal termination point. If a module is found defective, its instruction booklet should be consulted for maintenance data.

CAUTION

Remove power before removing or installing any module. The AGC system must be calibrated after repair or replacement of the second mixer, AM detector, second IF amplifier/filter, or AGC amplifier; see paragraph 5.3.3.1.

5.3.2 REPAIR

Repair procedures for the 1100-AR are grouped into three categories: base unit, front panel and internal plug-in modules. Repair procedures for the front panel plug-in modules are given in the applicable instruction manual. All electrical components used in the 1100-AR, excluding modules, are considered non-repairable and should be replaced when found defective.

5.3.2.1 BASE UNIT

No special tools or procedures are required to remove and replace components mounted on the base unit. The transformer and filter capacitor securing screws and nuts are accessible with the top cover removed. Series regulator transistors and load resistors are fixed to a mounting plate. This plate is secured to the rear panel with machine screws and will drop from the receiver with the screws removed.

5.3.2.2 FRONT PANEL

The majority of the front panel controls and indicators can be removed and replaced without removing the front panel from the receiver. However, the panel should be removed if there is a possibility of destroying or damaging any other components or wiring in the repair process. To remove the front panel, disconnect plug XA21 on the top of the receiver. Remove the knobs from the VIDEO BANDWIDTH KHZ and VIDEO COUPLING/ VIDEO SOURCE switches. Remove the four screws (two on either side) adjacent to the demodulator/IF filter slot. Remove the three Phillips screws on either side of the receiver chassis next to the front panel. Pull the front panel away from the chassis. All wiring is now exposed on the rear of the front panel. No special procedures are required to replace front panel components. After replacing components, verify all connections against the schematic diagram prior to replacing the front panel.

5.3.2.3 INTERNAL PLUG-IN MODULES

There are two types of plug-in modules in the 1100-AR: printed circuit cards and metal-encased modules. In both cases, the modules plug into base unit connectors. The metal-encased modules are held in place by a captive screw which must be released for removal of the module. A hole is provided in the modules for inserting a Microdyne 200-396 removal tool. To remove a module, simply insert the tool and lift out. To gain access to the circuitry in the metal-encased modules, the screws securing the wraparound cover must be removed. With the cover removed, the circuitry contained in the module is readily accessible.

The following procedure is recommended for removing components from a printed circuit board:

a. Gather the following material and equipment:

   1. Liquid soldering flux
   2. Flux remover
   3. Wire braid
   4. Soldering iron, soldering aid and longnose pliers

b. Dip one end of the braid in the soldering flux.

c. Place and hold the braid over the solder joint and apply heat; the braid will absorb most of the solder.

> **CAUTION**
>
> Excess heat may permanently damage the circuit board.

d. Apply heat directly to the solder joint and gently pry the component loose.

e. Clean the affected area using flux remover. If the hole remains clogged, repeat the process using the braid and the flux.

f. Position the component on the PC board.

g. Solder in place and trim the leads.

h. Clean the area with flux remover.

Table 5-3. Module Reference Data

A6 -	2nd Mixer		
	-0.5V AGC	0 dB gain (nominal)	
	-5.0V AGC	-6 dB gain (nominal)	
	Input Signal Range	-16 dBm to thermal noise	
A14 -	Video Amplifier		
	1 KHz Input	46 dB gain (nominal)	
	Rated Output	4V peak-to-peak (75 ohms)	
A10 -	Cal/Reference Oscillator		
	Output	10 MHz (±2 KHz) at approximately -20 dBm	
A28 -	SDU Buffer		
	Gain	Unity	
A18/A27 -	20-1100 Playback Converter		
	Input Signal Range	1 to 10V peak-to-peak	
	Output	Approximately -13 dBm	
A18 -	100-117 Playback Converter		
	Gain	-10 dB	
A19 -	10-1100 Record Converter		
	Output	2V peak-to-peak, into 75 ohms, with 50 mV input	
A3 -	RF Tuner		
	1111/1112/1113-VT(A)	17 (±3) dB gain	-0.5V AGC
	1114/1115/1116-VT(A)	14 (±2) dB gain	-0.5V AGC
	1118-VT(A)	16 (±4) dB gain	-0.5V AGC
A7 -	2nd IF Amplifier		
	Varies with bandwidth; see Table 5-2 in 2nd IF Amplifier instruction manual.		
A4 -	1st IF Filter (Standard)		
	Gain	Unity	
A5 -	2nd LO		
	Output	-10 to -6 dB (2nd Mixer)	
A15 -	AGC Amplifier		
	Check AGC System Calibration, see instruction booklet.		
A17 -	AFC Amplifier		
	Consult AFC Amplifier instruction booklet.		

5.3.3 ALIGNMENT/ADJUSTMENTS

No alignment procedure can be directly applied to the 1100-AR receiver as the modules are individually aligned. The recommended alignment procedure for the modules are provided in the instruction booklets with the exception of the video filters whose procedures are provided herein. After repairing and aligning any of the internal modules, the performance of the receiver should be checked using the procedures provided in paragraph 5.2.3.

5.3.3.1 AGC ADJUSTMENT

This procedure ensures the proper setting of the receiver AGC system and should be initiated after the repair and/or replacement of any of the following modules:

a. Second Mixer
b. AM Detector
c. Second IF Filter/Amplifier
d. AGC Amplifier

To adjust the AGC system, an HP606A signal generator and an HP412A DC voltmeter are required. The procedure for adjustment is:

a. Set the OPERATE MODE switch REC and allow 30 minutes for warmup. Remove the tuner and set the 2nd LO MODE switch to XTAL. If the receiver contains a phase demodulator, the 2ND LO MODE switch must also be set to XTAL to prevent locking and allow the envelope AGC to be set.

b. Remove the second IF filter/amplifier (A7) and inject a 10.000 MHz, -21 dBm signal into XA7-A1.

c. Connect the HP412A to J13 on the rear panel and adjust R20 on the AM detector for exactly +5.0V DC.

d. Disconnect the signal source and replace the IF filter/amplifier using the 200-494 test cable.

e. Remove the second mixer module (A6).

f. Connect the HP606A to XA6-A7.

g. Set the HP606A to exactly 10.000 MHz at -16 dBm.

h. Adjust R24 on the AM detector for +5V DC at J13. Then adjust R52 (R54 on the XTAL filters) on the second IF filter for -5V DC on the AGC buss.

i. Disconnect the HP606A and replace the mixer.

j. Install the tuner and set the receiver 1ST LO MODE switch to VFO.

k. Connect the HP412A to the AGC buss.

l. Rotate the TUNING control over the entire range and observe that the AGC voltage remains within a -0.2 to -0.8V DC range.

AGC Adjustment, continued

m. Adjust R49 on the second IF filter/amplifier, if necessary, to bring the AGC within the -0.2 to -0.8V DC range.

n. If R49 on the IF filter was adjusted in step m, it is necessary to repeat steps e through l.

o. Connect a signal generator compatible with the RF tuner to the receiver antenna input.

p. Adjust the receiver and signal generator to tune in a signal in the mid-range of the tuner.

q. Set the generator for a -7 dBm output and observe that the AGC buss voltage is -5.0 (±0.5) V DC.

r. Calibrate the receiver SIGNAL LEVEL meter and THRESHOLD control as directed in steps e through i of paragraph 3.3.1.1.

s. The procedure is completed. Disconnect all test equipment.

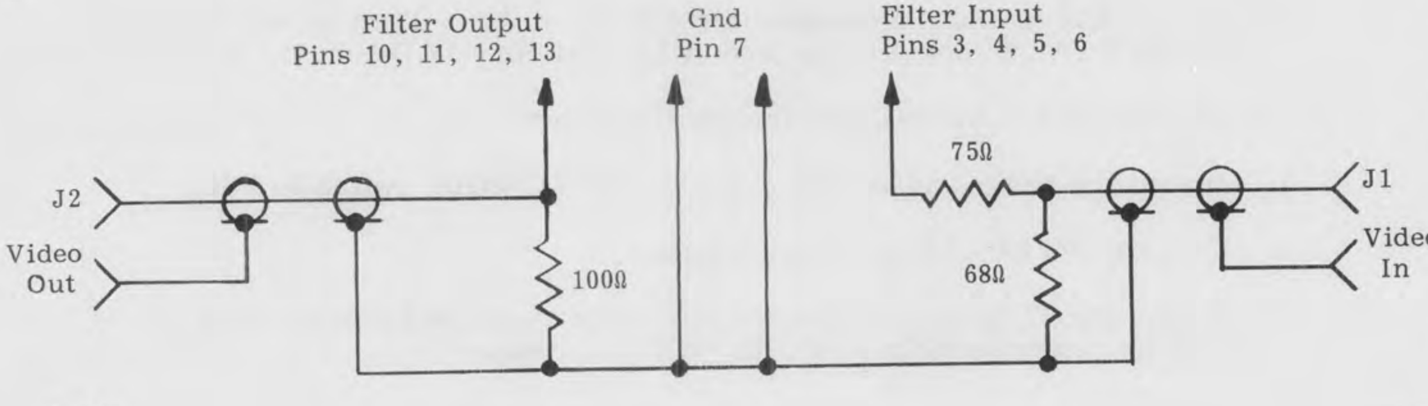
5.3.3.2 VIDEO FILTERS ALIGNMENT PROCEDURES

The most likely causes of a malfunction in the video filter are an open coil or broken connection. In the case of a repair to the filter, the alignment of the filter should be checked. The filters are aligned for the proper -3dB sine wave frequency roll-off and minimum overshoot for good phase linearity.

The following procedure refers to the inductors as input or output inductors rather than by reference designations. The input inductor is that connected to the video input terminal and the output inductor is that connected to the output terminal; see Figures 7-5 and 7-6 in Section VII.

Required Test Equipment:

AC VTVM	HP3400A
High Frequency Oscilloscope	HP180A/HP1801A/HP1820A
Signal Generator	HP651A
Square Wave Generator	HP211B
Video Filter Test Setup:	



Video Filters Alignment Procedures, continued

The input and output coaxial cable connections to the test fixture should be type RG-223/U not to exceed three feet in length terminated with BNC type connectors.

a. Preset the input and output inductors clockwise two turns from minimum inductance.

b. Connect the video filter to the test fixture as shown on preceding page.

c. Connect the HP651A 50-ohm output to the test fixture input J1 and set the frequency to 1 KHz.

d. Connect the HP3400A to the test fixture output J2 and adjust the HP651A output level for a 0 dB reading on the 0.3 volt of the HP3400A. The output level of the HP651A will be approximately 0.5 volts rms. Maintain this level for the -3 dB frequency adjustment in the next step.

e. Set the HP651 frequency to the -3 dB frequency of the filter. Do not change the HP651A output level from that established in step d. Adjust the input inductor for a -3 dB indication on the 0.3 volt range of the HP3400A.

f. Disconnect the HP651A from the test fixture input J1 and connect 50-ohm output of the HP211B to J1.

g. Disconnect the HP3400A from the test fixture output J2 and connect the vertical input of the HP180A to J2.

h. Set the HP211B frequency to one-fifth of the selected -3 dB frequency. Adjust the HP211B output level to obtain 0.7 volt peak square wave on the oscilloscope.

i. Observe the square wave on the HP180 and adjust the output inductor for a slight overshoot of 1 to 3%.

j. Repeat steps c through e to adjust the input inductor for the -3 dB frequency.

k. Repeat steps f through j.

l. Measure the -3 dB point of the filter and adjust the input inductor, if necessary, to obtain the -3 dB frequency specified.

SECTION VI
REPLACEABLE PARTS LIST

6.1 GENERAL

This section contains the replaceable parts list for the receiver base chassis and for those assemblies for which separate instruction manuals or booklets do not exist. When compiling a spares list or when ordering spares for the receiver using the parts list given herein, first determine the particular receiver configuration on hand. Certain components, such as rear panel connectors and module receptacles, listed herein may or may not be employed in the receiver depending on its configuration. All component information and receiver serial numbers should be included when ordering spare or replaceable parts.

6.2 MODULE/ASSEMBLY LISTING

Reference Designation	Description
A1	Positive Voltage Regulator, Microdyne 300-004; see instruction booklet
A2	Negative Voltage Regulator, Microdyne 300-005; see instruction booklet
A3	RF Tuner, Microdyne 1100 Series; see separate manual
A4	First IF Filter, Optional Module, Microdyne 100-159 (Wideband Standard); see instruction booklet
A5	Second Local Oscillator, Microdyne 100-086; see instruction booklet
A6	Second Mixer, Microdyne 103-097; see instruction booklet
A7	Second IF Filter/Amplifier, Microdyne 1100-I(B) Series; see separate manual
A8	AM Detector, Microdyne 100-090; see instruction booklet
A9	Demodulator, Microdyne 1100 Series; see separate manual
A10	Calibrate/Reference Oscillator, Microdyne 100-089; see instruction booklet
A11	Video Filter #1 (Standard), Microdyne 300-044; see paragraph 6.6
A12	Video Filter #2 thru #10; see paragraphs 6.7 thru 6.15
A13	Video Filter, Optional Module
A14	Video Amplifier, Microdyne 300-054; see instruction booklet
A15	AGC Amplifier, Microdyne 101-938; see instruction booklet
A16	Metering Amplifier, Microdyne 300-089; see instruction booklet
A17	AFC Amplifier, Microdyne 300-078; see instruction booklet
A18	Playback Converter, Optional Module, Microdyne 100-117 or 20-1100 Series (See A27); see instruction booklet
A19	Record Converter, Optional Module, 10-1100 Pre-D Series (Standard); see instruction booklet
A20	Display Converter, Optional Module, Microdyne 100-116; see instruction booklet
A21	Front Panel Assembly; see paragraph 6.5 for breakdown listing
A22	Base Chassis; see paragraph 6.3 or 6.4 for breakdown listing
A23	Spectrum Display Unit, Microdyne 1161-S(A); see separate manual
A24	Display Regulator, Microdyne 200-219; see paragraph 6.14 for breakdown listing
A25	Pre-D Record 1171-PP(A) (Standard), or Playback Converter 1181-PP(A) (Standard), Optional Modules; see separate manual
A26	Not Assigned
A27	Playback Converter, part of 20-1100; see A18 (Dual Module)
A28	SDU Buffer, Optional Module, Microdyne 100-662; see instruction booklet

6.3 A22, BASE CHASSIS (7" Version)

Reference Designation	Description
C1, C2	Capacitor, electrolytic, 5200 µF, GE 86F147L
C3, C4	Capacitor, tantalum, 47 µF, 35V, Kemet T362D476K035AS
C5, C7	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C8, C9	Not Used
C10 thru C13	Capacitor, electrolytic, 30 µF, 100V, Sprague TE1411
C14	Capacitor, 800 µF, 16V, Sprague 53D801F016FE6
C15, C16	Capacitor, ceramic, .33 µF ±20%, 100V, Erie 8131-100-651-334M
C17 thru C24	Capacitor, ceramic, .015 µF ±20%, 100V, Erie 8131-100-X5V-153M
C25	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C26	Capacitor, tantalum, 47 µF, 35V, Kemet T362D476K035AS
C27	Capacitor, 800 µF, 16V, Sprague 53D801F016FE6
CR1 thru CR3	Rectifier Bridge, Semtech SCAJ2
F1, F2	Fuse, 1.0 Amp, Slo-Blo, MDL-1A
FL1	Line Filter, Microdyne 200-055; see paragraph 6.15 for breakdown listing
J1	Connector, Cannon DBM-25S
J2	Connector, Amphenol UG-1095A
J3	Connector, Dage 30517-10
J4	Not Used
J5	Connector, Dage 30517-10
J6	Not Used
J7	Connector, Dage 30517-10
J8 thru J10	Not Used
J11	Connector, Dage 30517-10
J12	Connector, Dage 30517-10
J13	Not Used
J14 thru J16	Connector, Dage 30517-10
J17	Connector, integral part of FL1
J18 thru J20	Not Used
J21	Connector, Dage 30517-10

A22, Base Chassis (7" Version), continued

Reference Designation	Description
L1	Inductor, 1000μH, Jeffers 1331-35J
L2, L3	Inductor, 82.0μH, Jeffers 1315-10J
Q1, Q2	Transistor, pnp, Motorola 2N4901
Q3 thru Q5	Transistor, npn, Motorola 2N5067
Q6	Transistor, pnp, Motorola 2N4901
R1, R3	Resistor, wirewound, 0.33Ω ±10%, 2w, IRC BWH
R2, R4	Resistor, wirewound, 1Ω ±10%, 2w, IRC BWH
R5, R7	Resistor, wirewound, 300Ω ±10%, 2w, IRC BWH
R6, R8	Resistor, wirewound, 820Ω ±10%, 2w, IRC BWH
R9	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R10	Potentiometer, 25KΩ, Allen Bradley WA2L04S253UC
R11	Potentiometer, 10KΩ, Allen Bradley WA2L04S103UC
R12	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R13	Potentiometer, 100Ω, integral part of S3
R14	Resistor, fixed composition, 33KΩ ±5%, ¼w, Allen Bradley CB3335
R15	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R16	Resistor, fixed composition, 3.3KΩ ±5%, ¼w, Allen Bradley CB3325
R17, R18	Resistor, fixed composition, 200KΩ ±5%, ½w, Allen Bradley EB2045
R19	Resistor, fixed composition, 1.2KΩ ±5%, ½w, Allen Bradley EB1225
R20	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R21	Potentiometer, 50KΩ, Allen Bradley WA2L040S503UC
R22, R23	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R24	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215
R25, R26	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
S1, S2	Switch Assembly, Microdyne 200-109
S3	Switch, rotary, Microdyne 200-110
S4	Switch, toggle, C&K 7301
T1	Transformer, power, Microdyne 301-555
U1	Voltage Regulator, Motorola MC 7805CP
W1	Cable Assembly, Microdyne 201-734; included when A25 optional module is furnished
XA1, XA2	Connector, Cinch 250-15-30-201
XA3	Connector, Cannon DCMF-25W3S
XA3J1	Connector, Dage 11749-1
XA4, XA5	Connector, Cannon DBMF-13W3S
XA6, XA8	Connector, Cannon DDMF-24W7S
XA7	Connector, Cannon DBMF-17W2S
XA9	Connector, Cannon DDMF-36W4S

A22, Base Chassis (7" Version), continued

Reference Designation	Description
XA10	Connector, Cannon DBMF-13W3S
XA11, XA12	Connector, Cinch 250-15-30-201
XA13	Connector, Cinch 250-15-30-201, installed only if Module A13 is furnished
XA14 thru XA17	Connector, Cinch 250-15-30-201
XA18	Connector, Cannon DBMF-13W3S
XA19	Connector, Cannon DBMF-13W3S, installed only if Module A19 is furnished
XA20	Connector, Cannon DBMF-13W3S, installed only if Module A20 is furnished
XA21	Connector, AMP 205211-1
XA22	Not Assigned
XA23	Connector, Cannon DBMF-13W3S
XA24	Not Assigned
XA25	Connector, Cannon DBMF-13W3S, installed only if Module A25 is furnished
XA26	Not Assigned
XA27	Connector, Cannon DBMF-13W3S
XA28	Connector, Cannon DBMF-13W3S, installed only if Module A28 is furnished
XF1, XF2	Fuse Holder, Littelfuse 342004

6.4 A22, BASE CHASSIS (5" Version)

Reference Designation	Description
C1, C2	Capacitor, fixed, electrolytic, 5200µF, 30V, GE 86F147F
C3, C4	Capacitor, tantalum, 47µF ±10%, 35V, Kemet T360D476K035AS
C5	Capacitor, ceramic, .01µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C6	Capacitor, ceramic, .0047µF ±20%, 100V, Erie 8131-100-X5T-472M
C7	Not Assigned
C8, C9	Capacitor, ceramic, .33µF ±20%, 100V, Erie 8131-100-651-334M
C10 thru C13	Capacitor, ceramic, 30 pF, 100V, Sprague TE1411
C14	Capacitor, 800µF, 16V, Sprague TVA1162.3
C15, C16	Capacitor, ceramic, .33 pF ±10%, 100V, Erie 8131-100-651-334M
C17 thru C20	Capacitor, ceramic, .015µF ±20%, 100V, Erie 8131-100-X5V-153M
C21 thru C25	Not Assigned
C26	Capacitor, tantalum, 47µF, 35V, Kemet T360D476M035AS
C27	Capacitor, 800µF, 16V, Sprague TVA1162.3

A22, Base Chassis (5" Version), continued

Reference Designation	Description
CR1	Rectifier, bridge, Semtech SCAJ1
CR2, CR3	Rectifier, bridge, Semtech SCAJ2
F1	Fuse, 3AG, .75A, Slo-Blo
FL1	Line Filter, Microdyne 200-055
J1	Connector, Cinch DBM-25S
J2	Connector, Amphenol UG-1095A
J3 thru J11	Connector, Dage 30517-10
J12	Not Assigned
J13	Connector, Amphenol UG-1095A
J14 thru J16	Connector, Dage 30517-10
J17	Connector, integral part of FL1
L1	Inductor, 1000µH, Jeffers 1331-35J
Q1, Q2	Transistor, pnp, Motorola 2N4901
Q3 thru Q5	Transistor, npn, Motorola 2N5067
R1, R3	Resistor, wirewound, 0.33Ω ±10%, 2w, IRC BWH
R2, R4	Resistor, wirewound, 1Ω ±10%, 2w, IRC BWH
R5, R7	Resistor, wirewound, 300Ω ±10%, 2w, IRC BWH
R6, R8	Resistor, wirewound, 820Ω ±10%, 2w, IRC BWH
R9	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R10	Potentiometer, 25K, Ohmite AS3608
R11	Potentiometer, 10K, Ohmite AS3607
R12	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R13	Potentiometer, 100Ω, part of S3
R14	Not Assigned
R15	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R16	Resistor, fixed composition, 1.2KΩ ±5%, ½w, Allen Bradley EB1225
R17, R18	Resistor, fixed composition, 200KΩ ±5%, ½w, Allen Bradley EB2045
R19, R20	Not Assigned
R21	Potentiometer, 50KΩ, Allen Bradley WA2L040S503UC
R22, R23	Resistor, fixed composition, 20KΩ ±5%, ¼w, Allen Bradley CB2035
R24	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1005
R25, R26	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley EB1005
S1, S2	Switch Assembly, Microdyne 200-109
S3	Switch, rotary, Microdyne 200-110
S4	Switch, toggle, C&K 7301

A22, Base Chassis (5" Version), continued

Reference Designation	Description
T1	Power Transformer, spec., Microdyne 301-555
U1	Voltage Regulator, Motorola MC7805CP
XA1, XA2	Connector, Cinch 250-15-30-201
XA3	Connector, Cannon DCMF-25W3S
XA4, XA5	Connector, Cannon DBMF-13W3S
XA6, XA8	Connector, Cannon DDMF-24W7S
XA7	Connector, Cannon DBMF-17W2S
XA9	Connector, Cannton DDMF-36W4S
XA10	Connector, Cannon DBMF-13W3S
XA11, XA12	Connector, Cinch 250-15-30-201
XA13	Connector, Cinch 250-15-30-201, installed only if Module A13 is furnished
XA14, XA16	Connector, Cinch 250-15-30-201
XA15, XA17	Connector, Cinch 251-15-30-221
XA18	Connector, Cannon DBMF-13W3S
XA19	Connector, Cannon DBMF-13W3S, installed only if Module A19 is furnished
XA20	Connector, Cannon DBMF-13W3S, installed only if Module A20 is furnishe
XA21	Connector, AMP, Cannon 205-212-1
XF1, XF2	Fuseholder, Littelfuse 342004

6.5 A21, FRONT PANEL SUBASSEMBLY

Reference Designation	Description
DS1	Lamp, amber, Eldema CF03YTS2107
DS2	Lamp, white, Eldema CF03WTS2107
DS3	Lamp, red, Eldema LF03RTS2107
DS4	Lamp, green, Eldema CF03GTS2107
DS5	Lamp, amber, Eldema CF03YTS2107
J1	Connector, AMP 205-212-1
M1	Meter, tuning, Microdyne 200-008
M2	Meter, output, Microdyne 200-006
M3	Meter, deviation, Microdyne 200-004
M4	Meter, signal level, Microdyne 200-007
R1	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R2	Resistor, variable, 25KΩ, Beckman 78SR25K-BW
R3	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R4, R5	Resistor, variable, 25KΩ, Beckman 78SR25K-BW
R6	Resistor, variable, 10KΩ, Allen Bradley WA2G056S103UA
R7	Resistor, variable, 10KΩ, integral part of S3
R8	Resistor, variable, 25KΩ, Beckman 78SR25K-BW
R9	Resistor, fixed composition, 150Ω ±5%, ½w, Allen Bradley EB1515

A21, Front Panel Subassembly, continued

Reference Designation	Description
R10	Resistor, variable, 5KΩ, integral part of S4
R11	Resistor, variable, 50KΩ, Allen Bradley WA2G056S503UA
R12	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R13	Resistor, variable, 100Ω, Beckman 78SR100-BW
R14	Resistor, fixed composition, 4.7Ω ±5%, ½w, EB4R75
R15	Resistor, variable, 25K, Beckman 78SR25K-BW
R16	Resistor, fixed composition, 24KΩ ±5%, ¼w, Allen Bradley CB2435
R17	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R18	Resistor, fixed composition, 47KΩ ±5%, ¼w, Allen Bradley CB4735
S1, S2	Switch Assembly, Microdyne 200-106
S3	Switch, Microdyne 200-107
S4	Switch, Microdyne 200-108

6.6 A11, VIDEO FILTER #1 (300-044)

Reference Designation	Description
C1	Capacitor, film, 0.27μF, 80V, Sprague 192P2749R8
C2	Capacitor, film, 0.056μF, 80V, Sprague 192P5639R8
C3	Capacitor, film, 0.15 pF, 80V, Sprague 192P1549R8
C4	Capacitor, ceramic, 0.027μF ±10%, 100V, Erie 8131-100-W5R-273K
C5	Capacitor, film, 0.068μF, 80V, Sprague 192P6839R8
C6	Capacitor, ceramic, 0.015μF ±10%, 100V, Erie 8133-100-W5R-153K
C7	Capacitor, ceramic, 0.033μF ±10%, 100V, Erie 8133-100-W5R-333K
C8A	Capacitor, ceramic, 6800 pF ±10%, 100V, Erie 8121-100-W5R-682K
C8B	Capacitor, ceramic, 820 pF ±5%, 100V, Erie 8131-100-COG-821J
C9	Capacitor, ceramic, 0.018μF ±10%, 100V, Erie 8131-100-W5R-183K
C10	Capacitor, ceramic, 3600 pG ±10%, 100V, Erie 8121-100-W5R-362K
L1	Inductor, variable, 6.8μH, Cambion 3387-30
L2, L5	Inductor, variable, 1.5μH, Cambion 3387-26
L3	Inductor, variable, 3.3μH, Cambion 3387-28
L4	Inductor, variable, 1.0μH, Cambion 3387-25
L6	Inductor, variable, 470μH, Cambion 3387-23
L7	Inductor, variable, 680μH, Cambion 3387-24
L8	Inductor, variable, 220μH, Cambion 3387-21
L9	Inductor, variable, 330μH, Cambion 3387-22
L10	Inductor, variable, 100μH, Cambion 3387-19

6.7 A12, VIDEO FILTER #2 (300-045)

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pF ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pF ±10%, 100V, Erie 8121-100-W5R-152K
C3A	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C3B	Capacitor, ceramic, 1000 pF ±5%, 100V, Erie 8121-100-COG-102J
C4	Capacitor, ceramic, 910 pF ±5%, 100V, Erie 8121-100-COG-911J
C5	Capacitor, ceramic, 2200 pF ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pF ±5%, 100V, Erie 8121-100-COG-471J
C7	Capacitor, ceramic, 820 pF ±5%, 100V, Erie 8121-100-COG-821J
C8	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8121-100-COG-181J
L1	Inductor, variable, 150µH, Cambion 3387-10
L2, L5	Inductor, variable, 47µH, Cambion 3387-17
L3	Inductor, variable, 100µH, Cambion 3387-19
L4	Inductor, variable, 22µH, Cambion 3387-15
L6	Inductor, variable, 15µH, Cambion 3387-13
L7	Inductor, variable, 18µH, Cambion 3387-14
L8	Inductor, variable, 5.6µH, Cambion 3387-8

6.8 A12, VIDEO FILTER #3 (100-168)

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pF ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pF ±10%, 100V, Erie 8121-100-W5R-152K
C3	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pF ±5%, 100V, Erie 8121-100-COG-681J
C5	Capacitor, ceramic, 1800 pF ±10%, 100V, Erie 8121-100-W5R-182K
C6	Capacitor, ceramic, 390 pF ±5%, 100V, Erie 8121-100-COG-391J
C7	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C8	Capacitor, ceramic, 270 pF ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 150µH, Cambion 3387-20
L2	Inductor, variable, 47µH, Cambion 3387-17
L3	Inductor, variable, 68µH, Cambion 3387-18
L4	Inductor, variable, 18µH, Cambion 3387-14
L5	Inductor, variable, 33µH, Cambion 3387-16
L6	Inductor, variable, 10µH, Cambion 3387-11
L7	Inductor, variable, 22µH, Cambion 3387-15
L8	Inductor, variable, 6.8µH, Cambion 3387-9

6.9 A12, VIDEO FILTER #4 (100-169)

Reference Designation	Description
C1	Capacitor, ceramic, 5600 pF ±10%, 100V, Erie 8121-100-W5R-562K
C2	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C3	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pF ±5%, 100V, Erie 8121-100-COG-681J
C5	Capacitor, ceramic, 2200 pF ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pF ±5%, 100V, Erie 8121-100-COG-471J
C7	Capacitor, ceramic, 1800 pF ±10%, 100V, Erie 8121-100-W5R-182K
C8	Capacitor, ceramic, 390 pF ±5%, 100V, Erie 8121-100-COG-391J
L1	Inductor, variable, 100µH, Cambion 3387-19
L2	Inductor, variable, 33µH, Cambion 3387-16
L3	Inductor, variable, 68µH, Cambion 3387-18
L4	Inductor, variable, 18µH, Cambion 3387-14
L5	Inductor, variable, 47µH, Cambion 3387-17
L6	Inductor, variable, 15µH, Cambion 3387-13
L7	Inductor, variable, 33µH, Cambion 3387-16
L8	Inductor, variable, 10µH, Cambion 3387-11

6.10 A12, VIDEO FILTER #5 (300-193)

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pF ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pF ±10%, 100V, Erie 8121-100-W5R-152K
C3	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pF ±5%, 100V, Erie 8121-100-COG-681J
C5	Capacitor, ceramic, 2200 pF ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pF ±5%, 100V, Erie 8121-100-COG-471J
C7	Capacitor, ceramic, 1800 pF ±10%, 100V, Erie 8121-100-W5R-182K
C8	Capacitor, ceramic, 390 pF ±5%, 100V, Erie 8121-100-COG-391J
C9	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C10	Capacitor, ceramic, 270 pF ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 150µH, Cambion 3387-20
L2	Inductor, variable, 47µH, Cambion 3387-17
L3	Inductor, variable, 68µH, Cambion 3387-18
L4	Inductor, variable, 18µH, Cambion 3387-14
L5	Inductor, variable, 47µH, Cambion 3387-17
L6	Inductor, variable, 15µH, Cambion 3387-13
L7	Inductor, variable, 33µH, Cambion 3387-16
L8	Inductor, variable, 10µH, Cambion 3387-11
L9	Inductor, variable, 22µH, Cambion 3387-15
L10	Inductor, variable, 6.8µH, Cambion 3387-9

6.11 A12, VIDEO FILTER #6 (100-170)

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pF ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pF ±10%, 100V, Erie 8121-100-W5R-152K
C3A	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C3B	Capacitor, ceramic, 1000 pF ±5%, 100V, Erie 8121-100-COG-102J
C4	Capacitor, ceramic, 910 pF ±5%, 100V, Erie 8121-100-COG-911J
C5	Capacitor, ceramic, 2200 pF ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pF ±5%, 100V, Erie 8121-100-COG-471J
C7	Capacitor, ceramic, 1800 pF ±10%, 100V, Erie 8121-100-W5R-182K
C8	Capacitor, ceramic, 390 pF ±5%, 100V, Erie 8121-100-COG-391J
C9	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C10	Capacitor, ceramic, 270 pF ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 150μH, Cambion 3387-20
L2	Inductor, variable, 47μH, Cambion 3387-17
L3	Inductor, variable, 100μH, Cambion 3387-19
L4	Inductor, variable, 22μH, Cambion 3387-15
L5	Inductor, variable, 47μH, Cambion 3387-17
L6	Inductor, variable, 15μH, Cambion 3387-13
L7	Inductor, variable, 33μH, Cambion 3387-16
L8	Inductor, variable, 10μH, Cambion 3387-11
L9	Inductor, variable, 22μH, Cambion 3387-15
L10	Inductor, variable, 6.8μH, Cambion 3387-9

6.12 A12, VIDEO FILTER #7 (100-318)

Reference Designation	Description
C1	Capacitor, ceramic, 5600 pF ±10%, 100V, Erie 8121-100-W5R-562K
C2	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C3	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pF ±5%, 100V, Erie 8121-100-COG-681J
C5	Capacitor, ceramic, 2200 pF ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pF ±5%, 100V, Erie 8121-100-COG-471J
C7	Capacitor, ceramic, 1800 pF ±10%, 100V, Erie 8121-100-W5R-182K
C8A	Capacitor, ceramic, 390 pF ±5%, 100V, Erie 8121-100-COG-391J
C9	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C10	Capacitor, ceramic, 270 pF ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 100μH, Cambion 3387-19
L2	Inductor, variable, 33μH, Cambion 3387-16
L3	Inductor, variable, 68μH, Cambion 3387-18
L4	Inductor, variable, 18μH, Cambion 3387-14
L5	Inductor, variable, 47μH, Cambion 3387-17
L6	Inductor, variable, 15μH, Cambion 3387-13
L7	Inductor, variable, 33μH, Cambion 3387-16
L8	Inductor, variable, 10μH, Cambion 3387-11
L9	Inductor, variable, 22μH, Cambion 3387-15
L10	Inductor, variable, 6.8μH, Cambion 3387-9

6.13 A12, VIDEO FILTER #8 (100-430)

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pF ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pF ±10%, 100V, Erie 8121-100-W5R-152K
C3	Capacitor, ceramic, 3300 pF ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pF ±5%, 100V, Erie 8121-100-COG-681J
C5	Capacitor, ceramic, 1800 pF ±10%, 100V, Erie 8121-100-W5R-182K
C6	Capacitor, ceramic, 390 pF ±5%, 100V, Erie 8121-100-COG-391J
C7	Capacitor, ceramic, 1200 pF ±10%, 100V, Erie 8121-100-W5R-122K
C8	Capacitor, ceramic, 270 pF ±5%, 100V, Erie 8121-100-COG-271J
C9	Capacitor, ceramic, 820 pF ±5%, 100V, Erie 8121-100-COG-821J
C10	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8121-100-COG-181J
L1	Inductor, variable, 150 µH, CTC 3387-20
L2	Inductor, variable, 47 µH, CTC 3387-17
L3	Inductor, variable, 68 µH, CTC 3387-18
L4	Inductor, variable, 18 µH, CTC 3387-14
L5	Inductor, variable, 33 µH, CTC 3387-16
L6	Inductor, variable, 10 µH, CTC 3387-11
L7	Inductor, variable, 22 µH, CTC 3387-15
L8	Inductor, variable, 6.8 µH, CTC 3387-9
L9	Inductor, variable, 18 µH, CTC 3387-14
L10	Inductor, variable, 5.6 µH, CTC 3387-8

6.14 A12, VIDEO FILTER #9 (101-696)

Reference Designation	Description
C1	Capacitor, ceramic, .15 µF, Sprague 192P1549R8
C2	Capacitor, ceramic, .027 µF, Erie 8133-100-W59-273K
C3	Capacitor, ceramic, .068 µF, Sprague 192P6839R8
C4	Capacitor, ceramic, .015 µF, Erie 8131-100-W5R-153K
C5	Capacitor, ceramic, .033 µF, Erie 8131-100-W5R-333K
C6A	Capacitor, ceramic, 6800 pF, Erie 8121-100-W5R-682K
C6B	Capacitor, ceramic, 680 pF, Erie 8121-100-COG-681J
C7	Capacitor, ceramic, .018 pF, Erie 8131-100-W5R-183K
C8A	Capacitor, ceramic, 3300 pF, Erie 8121-100-W5R-332K
C8B	Capacitor, ceramic, 300 pF, Erie 8121-100-COG-301J
C9	Capacitor, ceramic, 6800 pF, Erie 8121-100-W5R-682K
C10	Capacitor, ceramic, 1500 pF, Erie 8121-100-W5R-152K
L1	Inductor, variable, 3.3 MH, CTC 3387-28
L2	Inductor, variable, 1.0 MH, CTC 3387-25
L3	Inductor, variable, 1.5 MH, CTC 3387-26
L4	Inductor, variable, 470 µH, CTC 3387-23
L5	Inductor, variable, 680 µH, CTC 3387-24
L6	Inductor, variable, 220 µH, CTC 3387-21
L7	Inductor, variable, 330 µH, CTC 3387-22
L8	Inductor, variable, 100 µH, CTC 3387-19
L9	Inductor, variable, 150 µH, CTC 3387-20
L10	Inductor, variable, 47 µH, CTC 3387-17

6.15 A12, VIDEO FILTER #10 (101-697)

Reference Designation	Description
C1	Capacitor, ceramic, 3300 pF, Erie 8121-100-W5R-332K
C2	Capacitor, ceramic, 680 pF, Erie 8121-100-W5R-681K
C3	Capacitor, ceramic, 2200 pF, Erie 8121-100-W5R-222K
C4	Capacitor, ceramic, 470 pF, Erie 8121-100-COG-471J
C5	Capacitor, ceramic, 1800 pF, Erie 8121-100-W5R-182K
C6	Capacitor, ceramic, 390 pF, Erie 8121-100-COG-391J
C7	Capacitor, ceramic, 1200 pF, Erie 8121-100-W5R-122K
C8	Capacitor, ceramic, 270 pF, Erie 8121-100-COG-271J
C9	Capacitor, ceramic, 820 pF, Erie 8131-100-COG-821J
C10	Capacitor, ceramic, 180 pF, Erie 8121-100-COG-181J
L1	Inductor, variable, 68 μH, CTC 3387-18
L2	Inductor, variable, 18 μH, CTC 3387-14
L3, L5	Inductor, variable, 33 μH, CTC 3387-16
L4	Inductor, variable, 8.2 μH, CTC 3387-10
L6	Inductor, variable, 10 μH, CTC 3387-11
L7	Inductor, variable, 22 μH, CTC 3387-15
L8	Inductor, variable, 6.8 μH, CTC 3387-9
L9	Inductor, variable, 18 μH, CTC 3387-14
L10	Inductor, variable, 5.6 μH, CTC 3387-8

6.16 DISPLAY REGULATOR

Reference Designation	Description
C1	Capacitor, tantalum, 2.2 μF ±10%, 20V, Sprague 150D225X9020A2
C2	Capacitor, tantalum, 47 μF, 20V, Kemet T362C476M020AS
C3	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
Q1, Q2	Transistor, PNP, Motorola 2N2907
Q3	Transistor, NPN, Motorola 2N2222
R1	Resistor, 1.0 Ω, 2w, IRC BWH, nominal value
R2	Resistor, fixed composition, 1.5K ±5%, 1w, Allen Bradley GB1525
R3	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R4	Resistor, 820 Ω ±5%, 2w, IRC BWG
R5	Not Assigned
R6	Resistor, 7.5 Ω ±5%, factory selectable

6.17 FL1, LINE FILTER ASSEMBLY

Reference Designation	Description
C1, C6	Filtercon, Erie 1201-052
C2, C4	Capacitor, 1000 pF ±20%, 1000V, Sprague 5GA-D10
C3, C5	Capacitor, 220 pF ±20%, 1000V, Sprague 5GA-T22
L1, L4	Inductor, 0.22 μH ±20%, Jeffers 4415-2M
L2, L3	Inductor, 1.0 μH ±10%, Jeffers 4425-6K

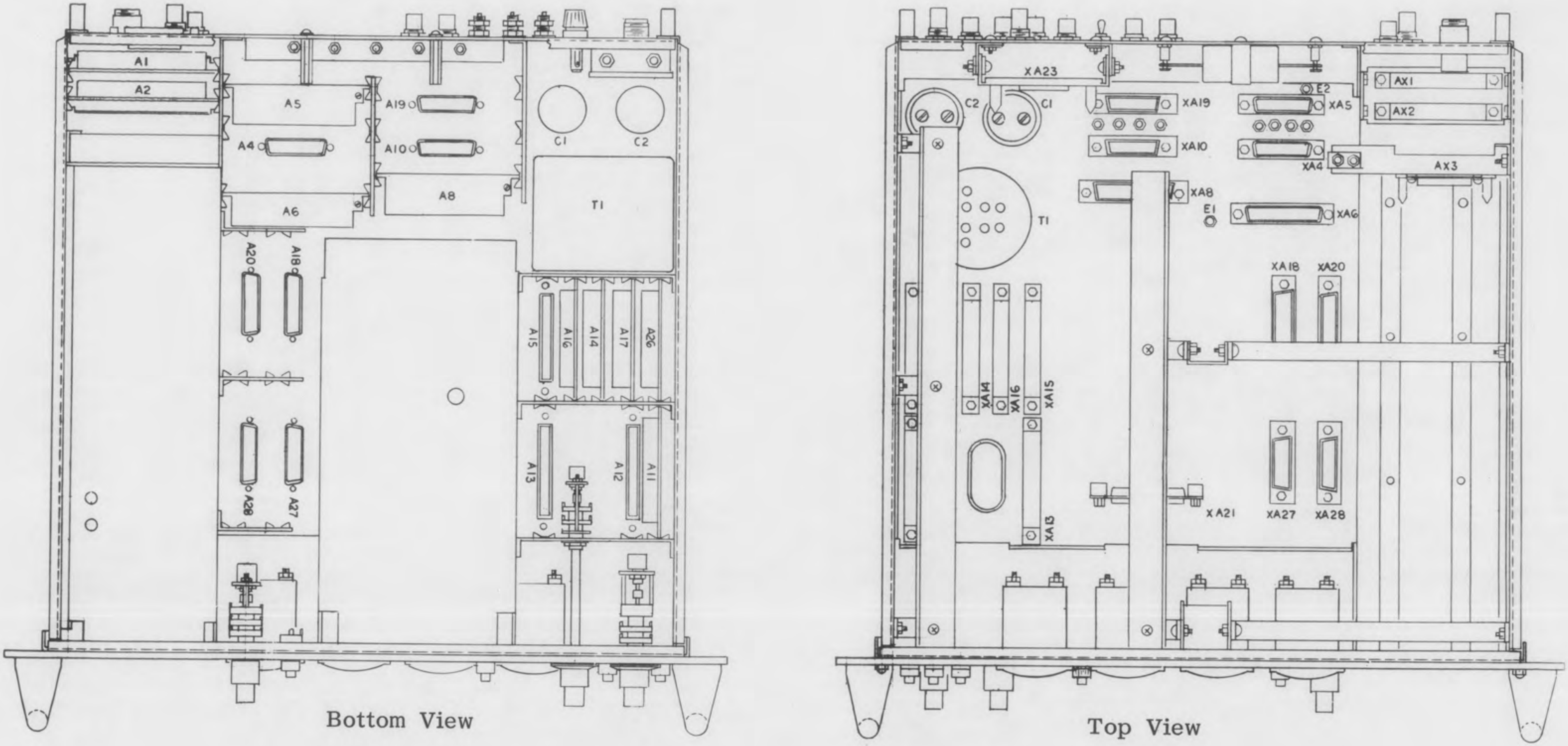


Figure 6-1. Top and Bottom Views of Chassis with Cover Removed

SECTION VII
MAINTENANCE DRAWINGS

7.1 INTRODUCTION

This section of the manual contains 1100-AR reference diagrams, they are supplied as an aid in troubleshooting the receiver. They consist of a wiring diagram of the base chassis, a wiring diagram of the front panel, power supply schematic diagram and assembly/schematic diagrams of the video filters. Reference diagrams for the internal subassemblies used in the receiver are supplied in their respective booklets.

Unless otherwise specified, the following information applies to each schematic diagram:

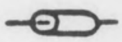
a. Capacitor values greater than 1.0 are in picofarads.

b. Capacitor values less than 1.0 are in microfarads.

c. Inductor values are in microhenrys.

d. Resistor values are in ohms: k = x 1000; m = x 1,000,000.

e. * denotes selected value.

f.  ferrite bead.

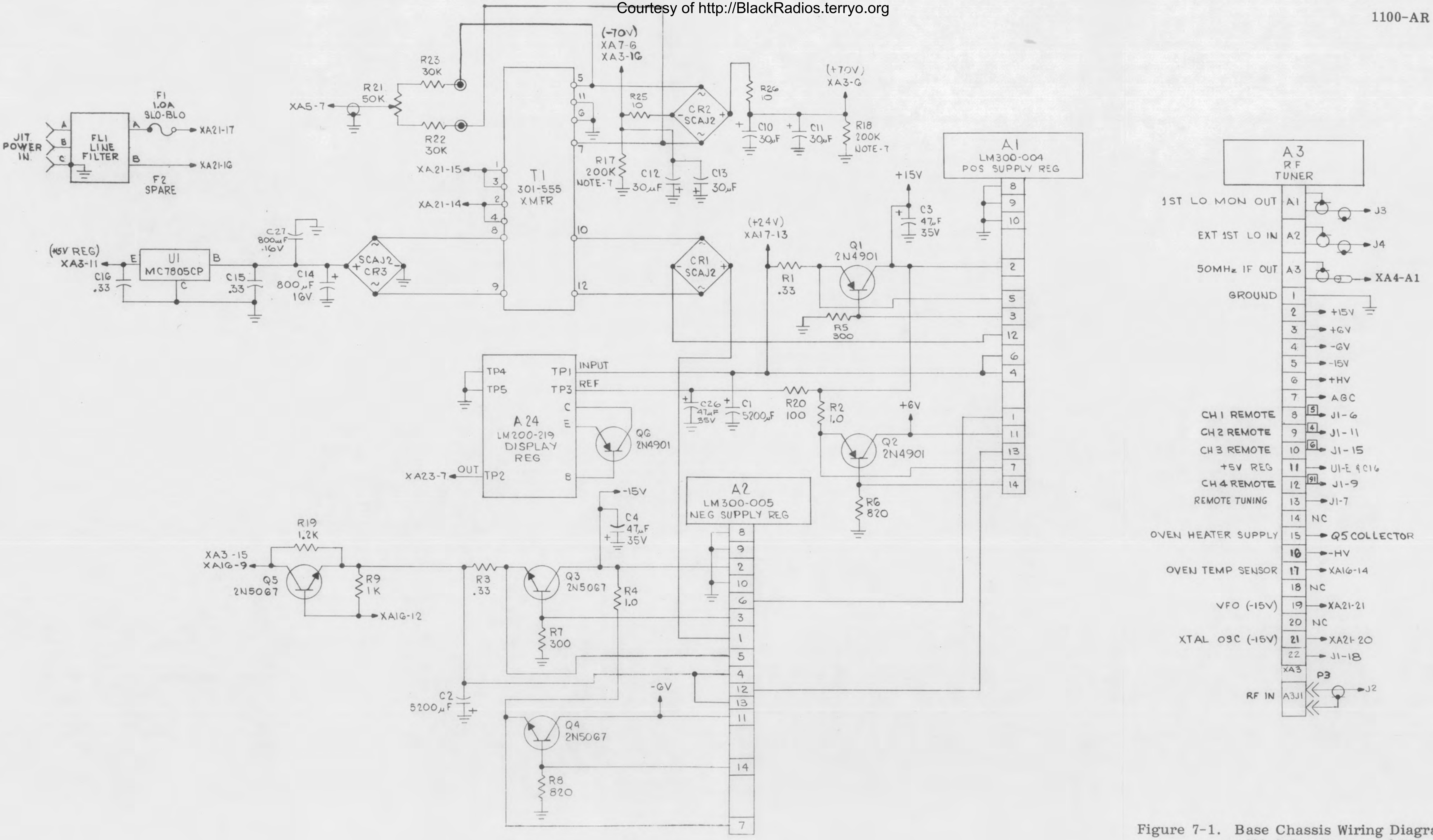
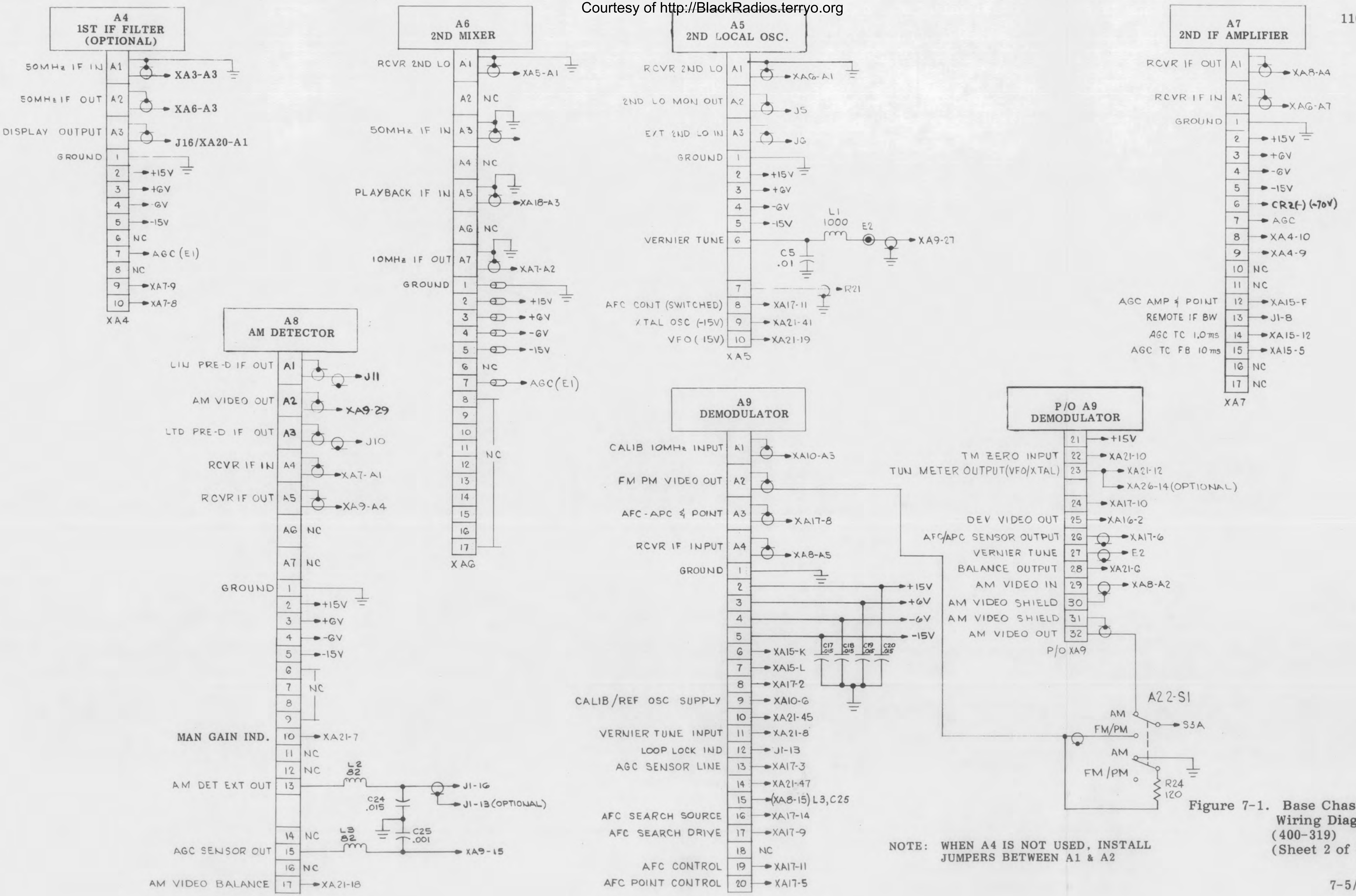


Figure 7-1. Base Chassis Wiring Diagram (400-319) (Sheet 1 of 5)



NOTE: WHEN A4 IS NOT USED, INSTALL JUMPERS BETWEEN A1 & A2

Figure 7-1. Base Chassis Wiring Diagram (400-319) (Sheet 2 of 5)

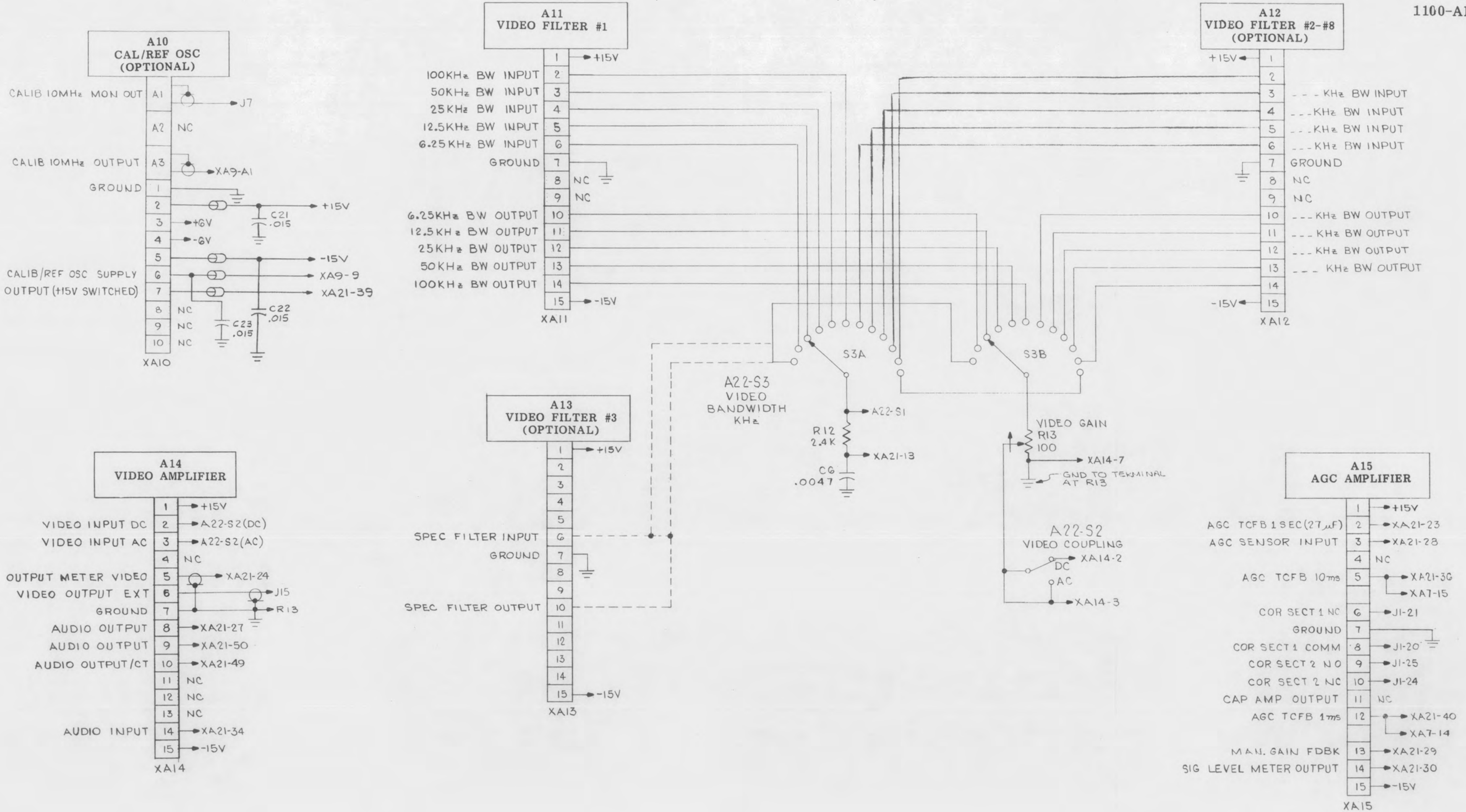


Figure 7-1. Base Chassis Wiring Diagram
(400-319) (Sheet 3 of 5)

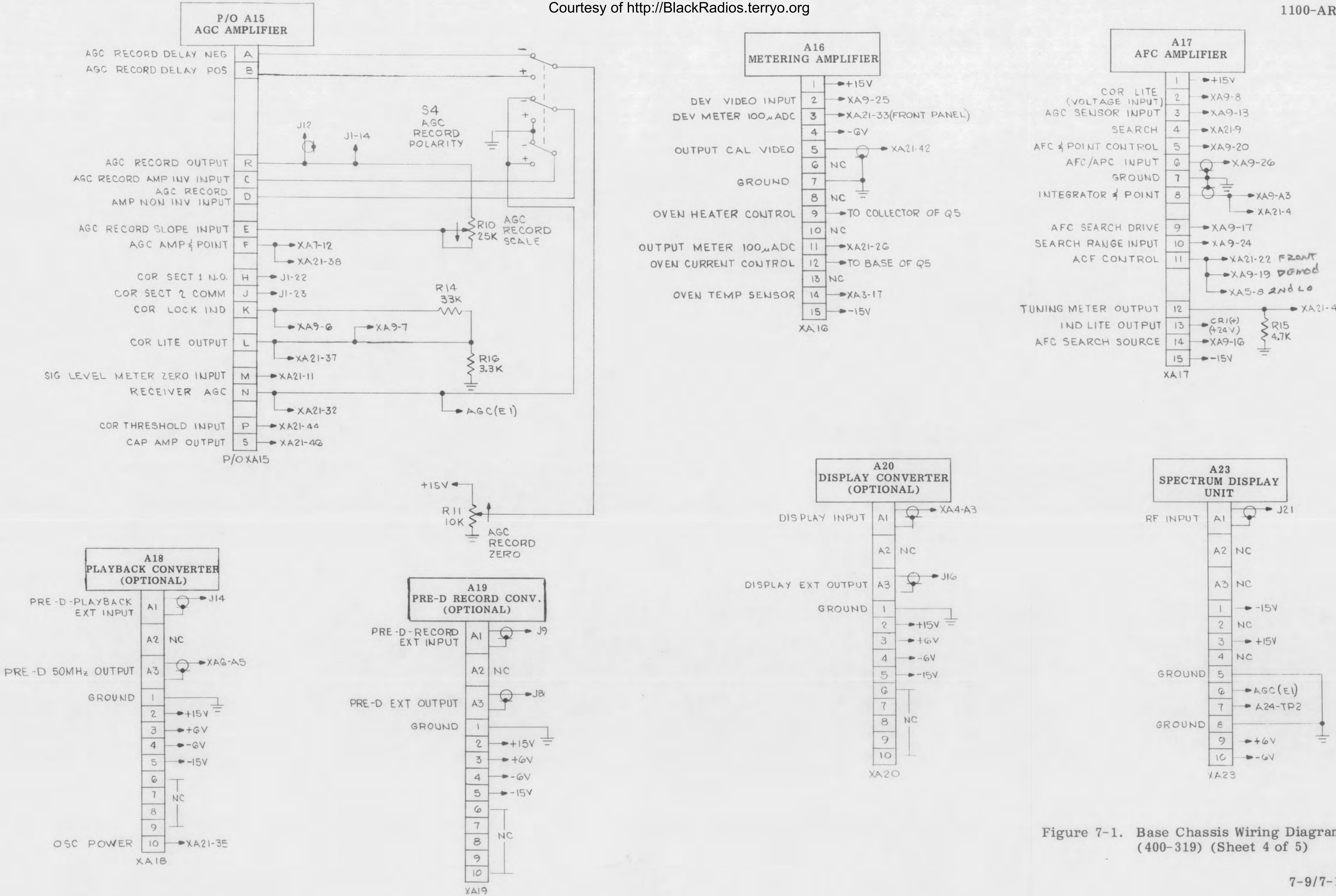


Figure 7-1. Base Chassis Wiring Diagram (400-319) (Sheet 4 of 5)

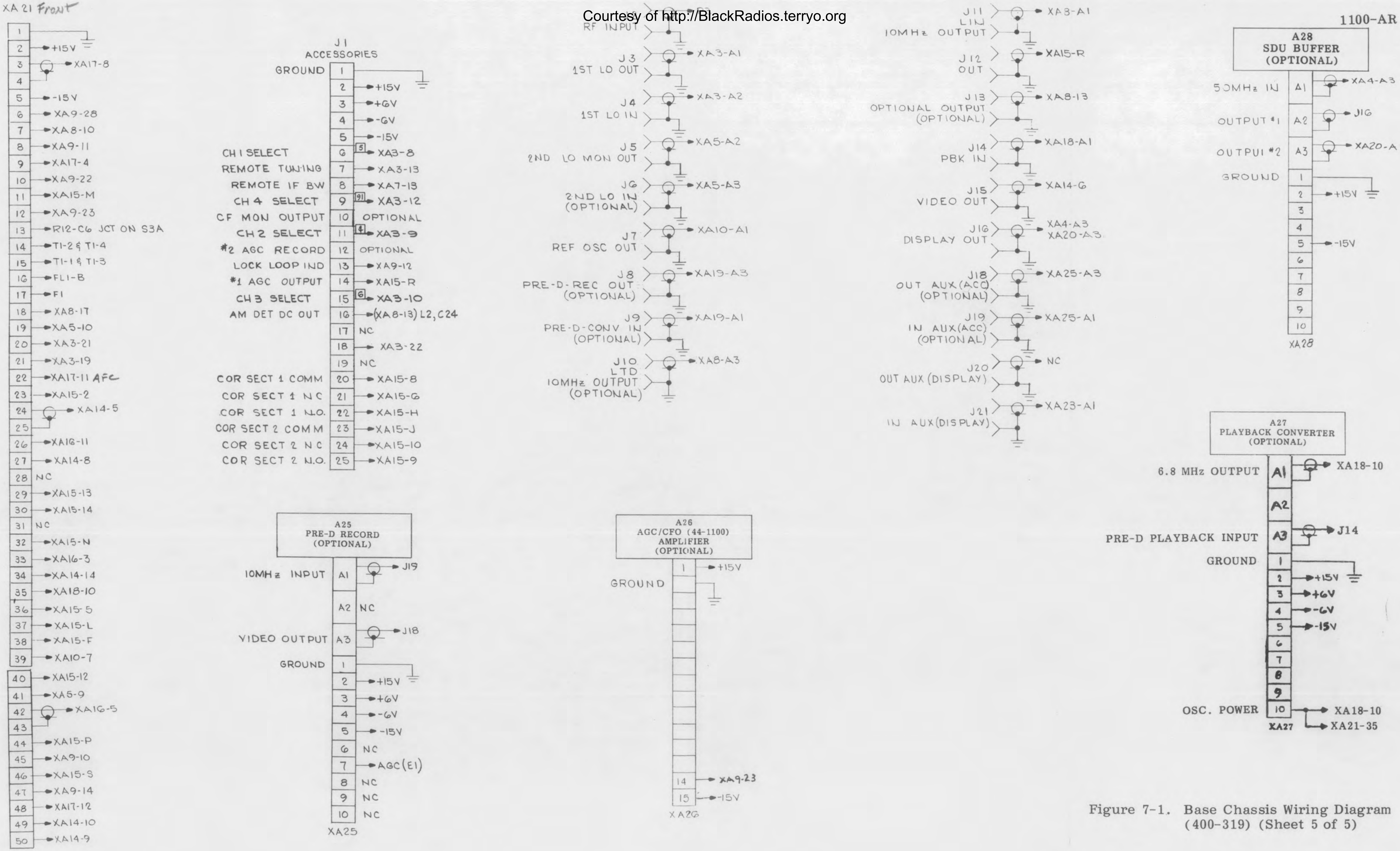


Figure 7-1. Base Chassis Wiring Diagram (400-319) (Sheet 5 of 5)

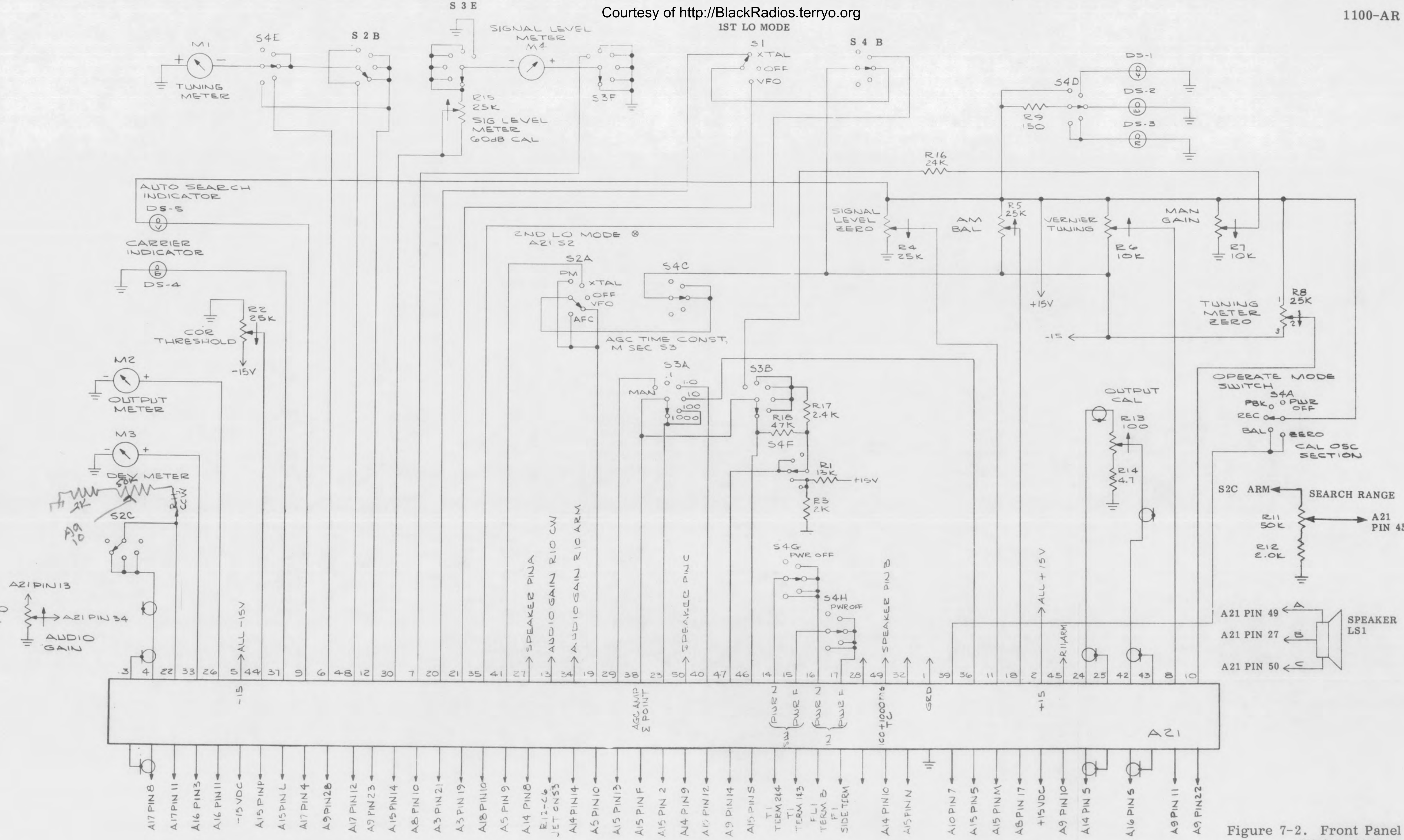


Figure 7-2. Front Panel Wiring Diagram (400-059)

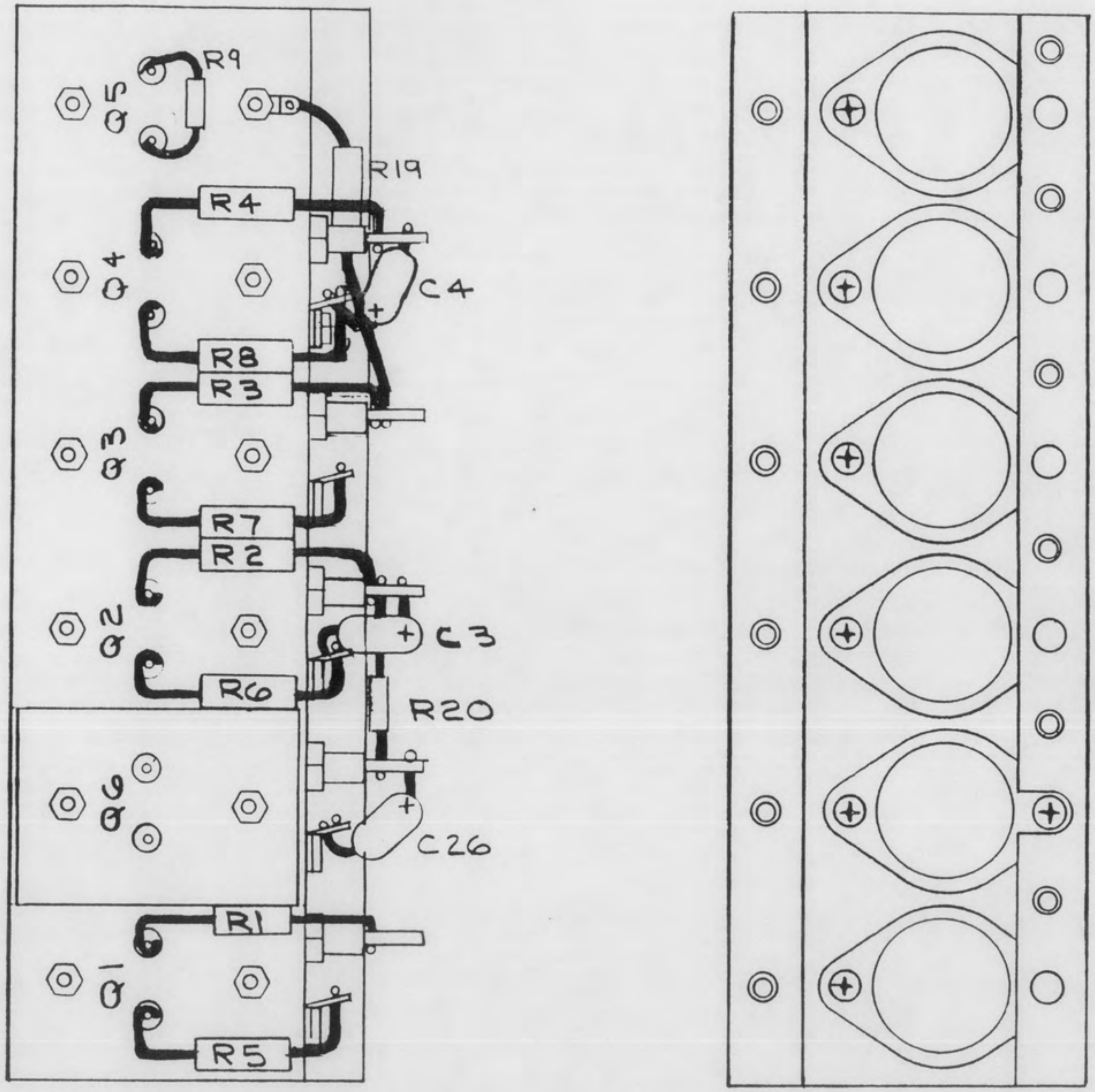
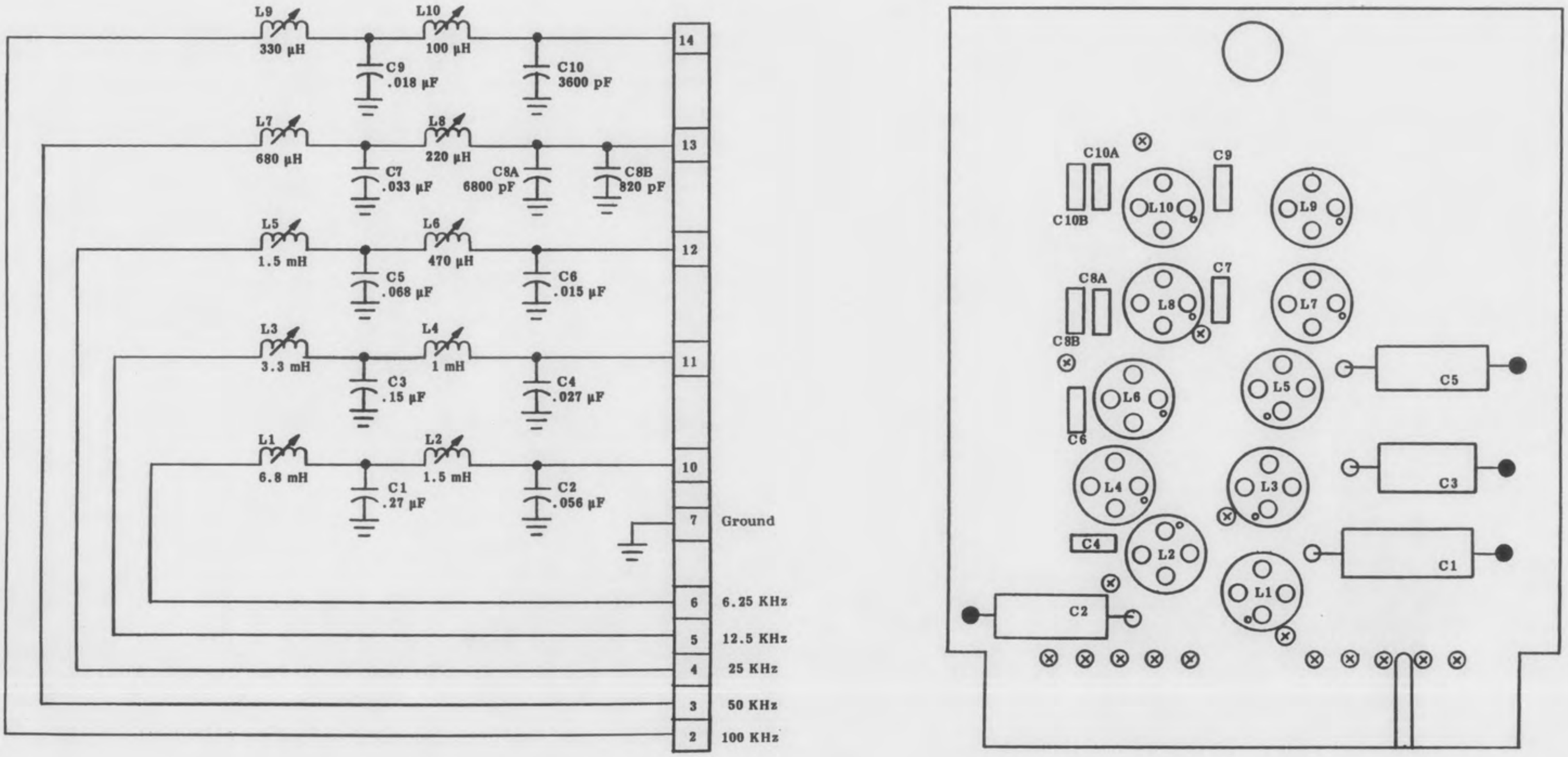


Figure 7-3. Power Transistors Assembly and Wiring Diagram (301-309)

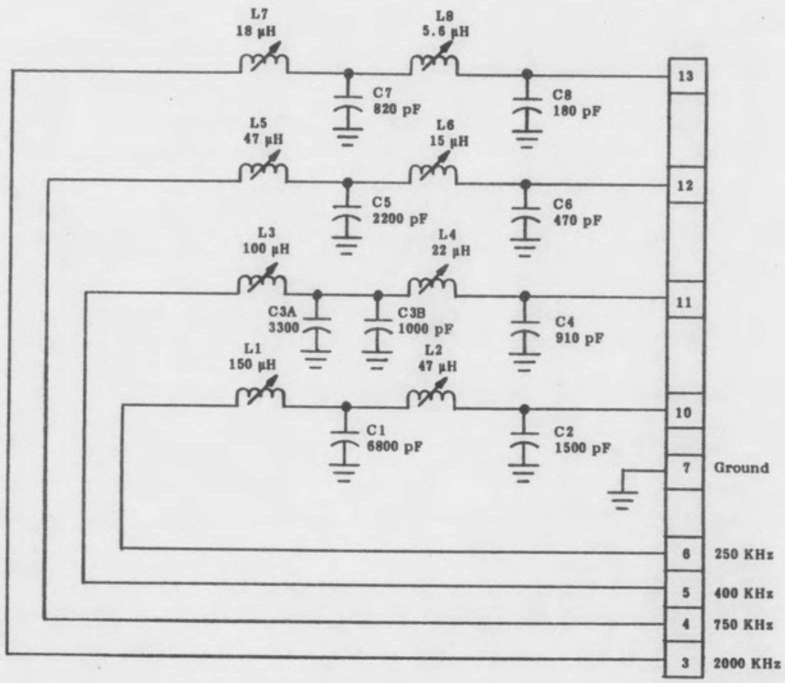


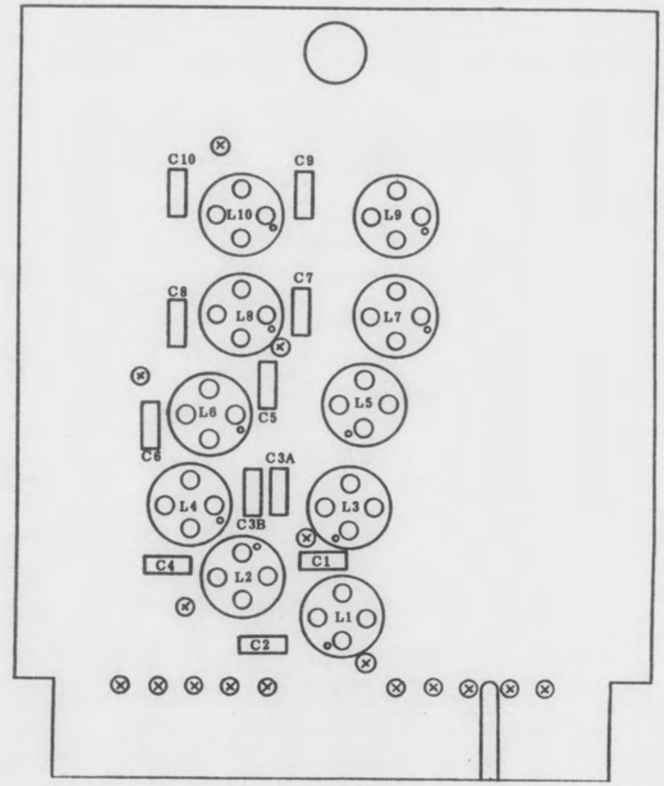
NOTE:

Values shown are for video filter #1. See Replaceable Parts List for video filters #5, #6, #7 and #8.

	Filter			
Pin	#5	#6	#7	#8
6	250 KHz	250 KHz	250 KHz	250 KHz
5	500 KHz	400 KHz	500 KHz	500 KHz
4	750 KHz	750 KHz	750 KHz	1000 KHz
3	1000 KHz	1000 KHz	1000 KHz	1500 KHz
2	1500 KHz	1500 KHz	1500 KHz	2000 KHz

Figure 7-4. Video Filter #1, #5, #6, #7 and #8
Schematic/Assembly Drawings

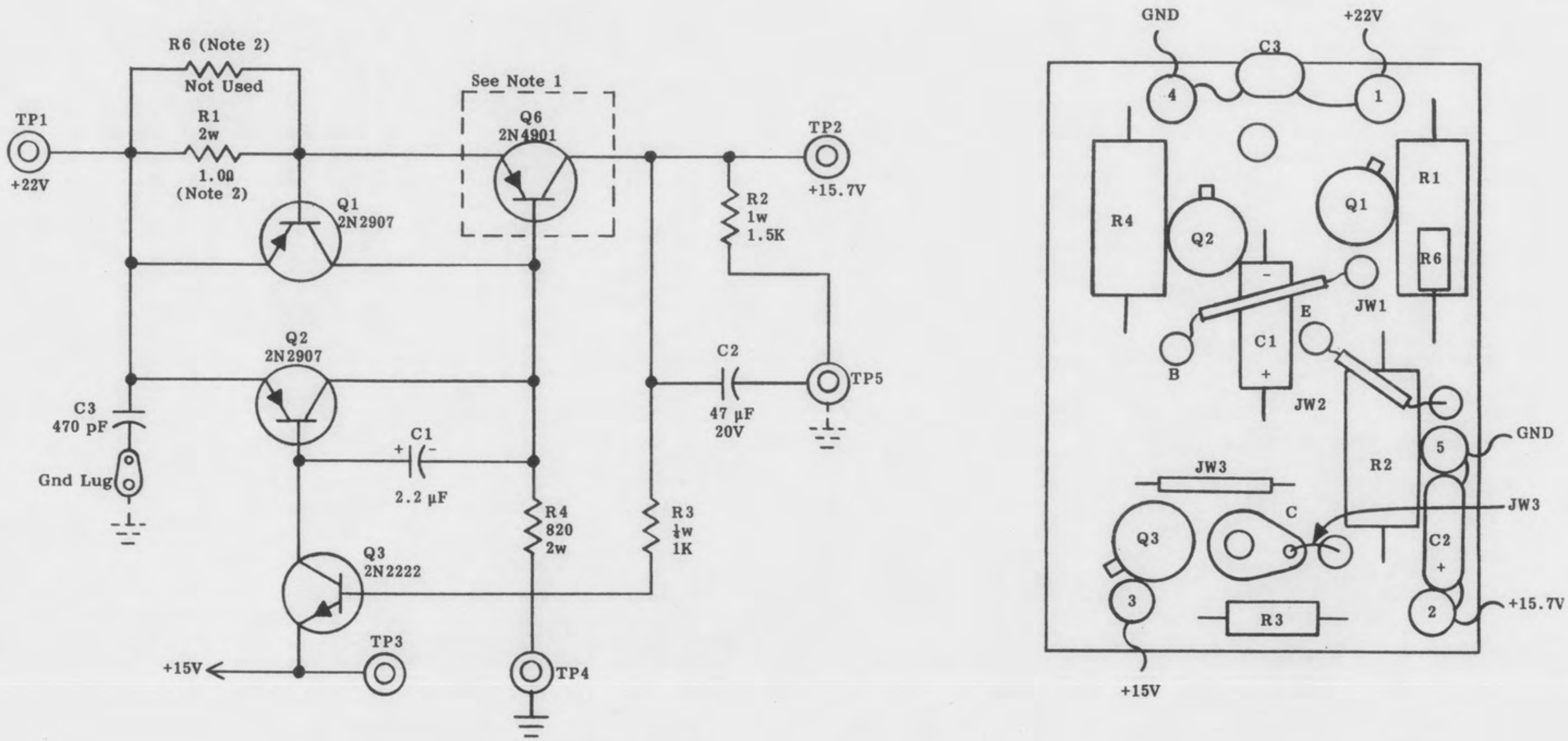




NOTE:
Values shown are video filter #2. See Replaceable Parts List for video filters #3 and #4.

	Filter	
Pin	#3	#4
6	250 KHz	300 KHz
5	500 KHz	500 KHz
4	1000 KHz	750 KHz
3	1500 KHz	1000 KHz

Figure 7-5. Video Filter #2, #3 and #4
Schematic/Assembly Drawings



NOTES:
1. Q6 located on Main Chassis
2. R6 used when R1 is 1.2K
   R1 may be 1.2K or 1.0Ω selectable.

Figure 7-6. A24, Display Regulator Schematic/Assembly Drawings

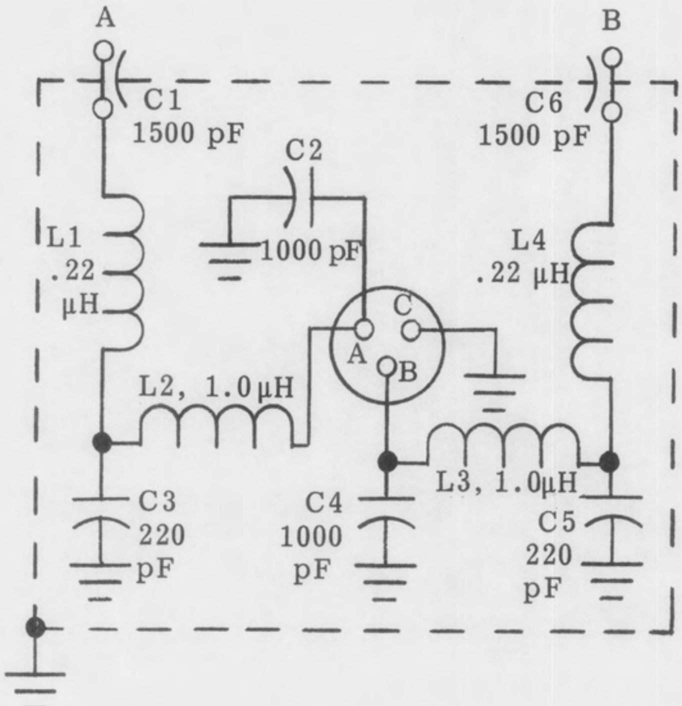
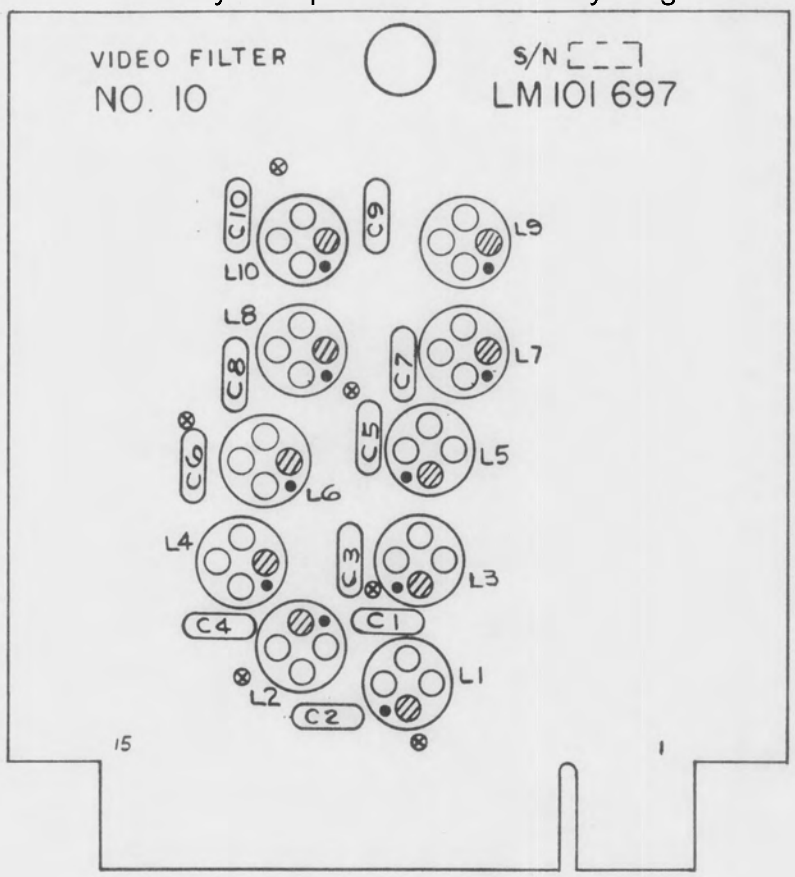


Figure 7- 7. FL1 Line Filter Assembly Schematic Diagram



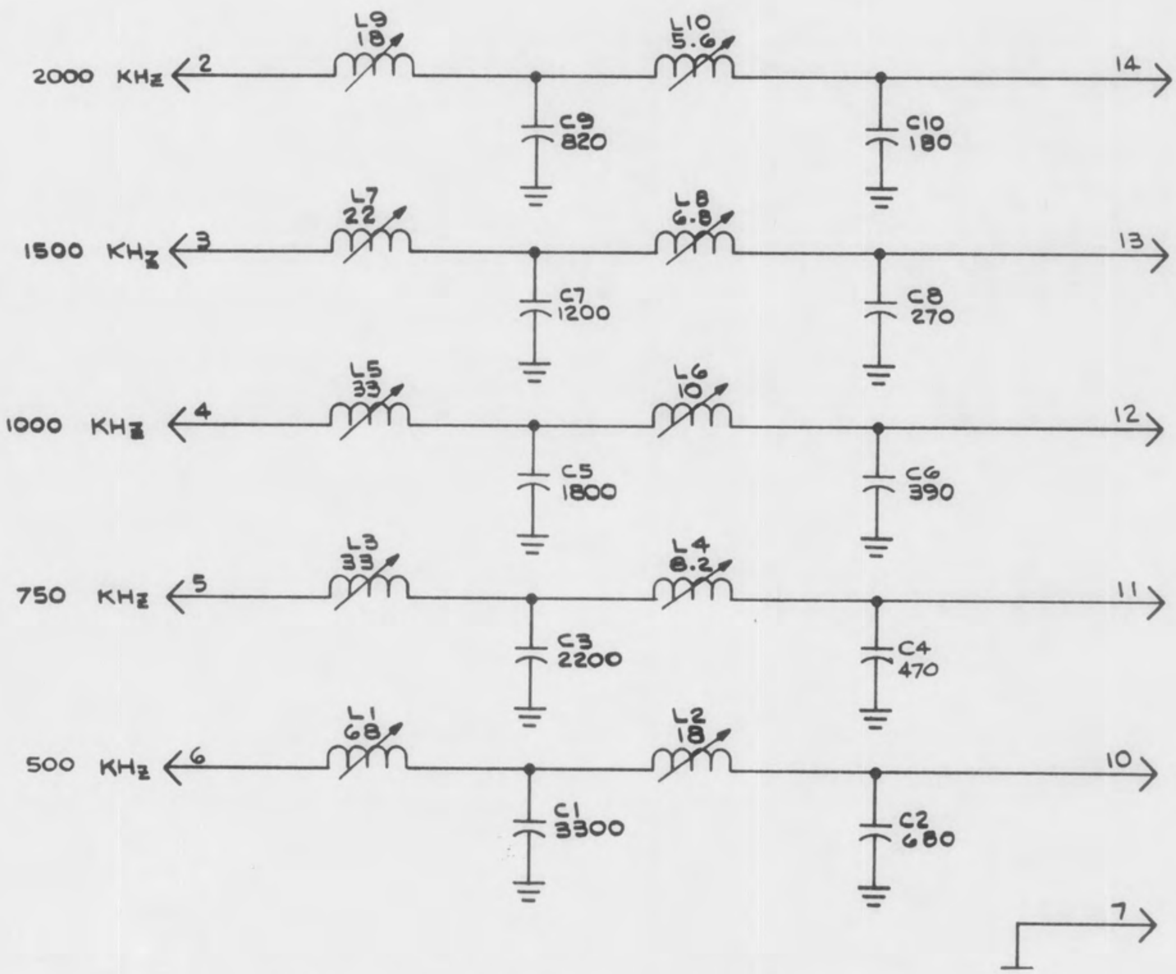


Figure 7-9. Video Filter #10 Schematic/
Assembly Diagram

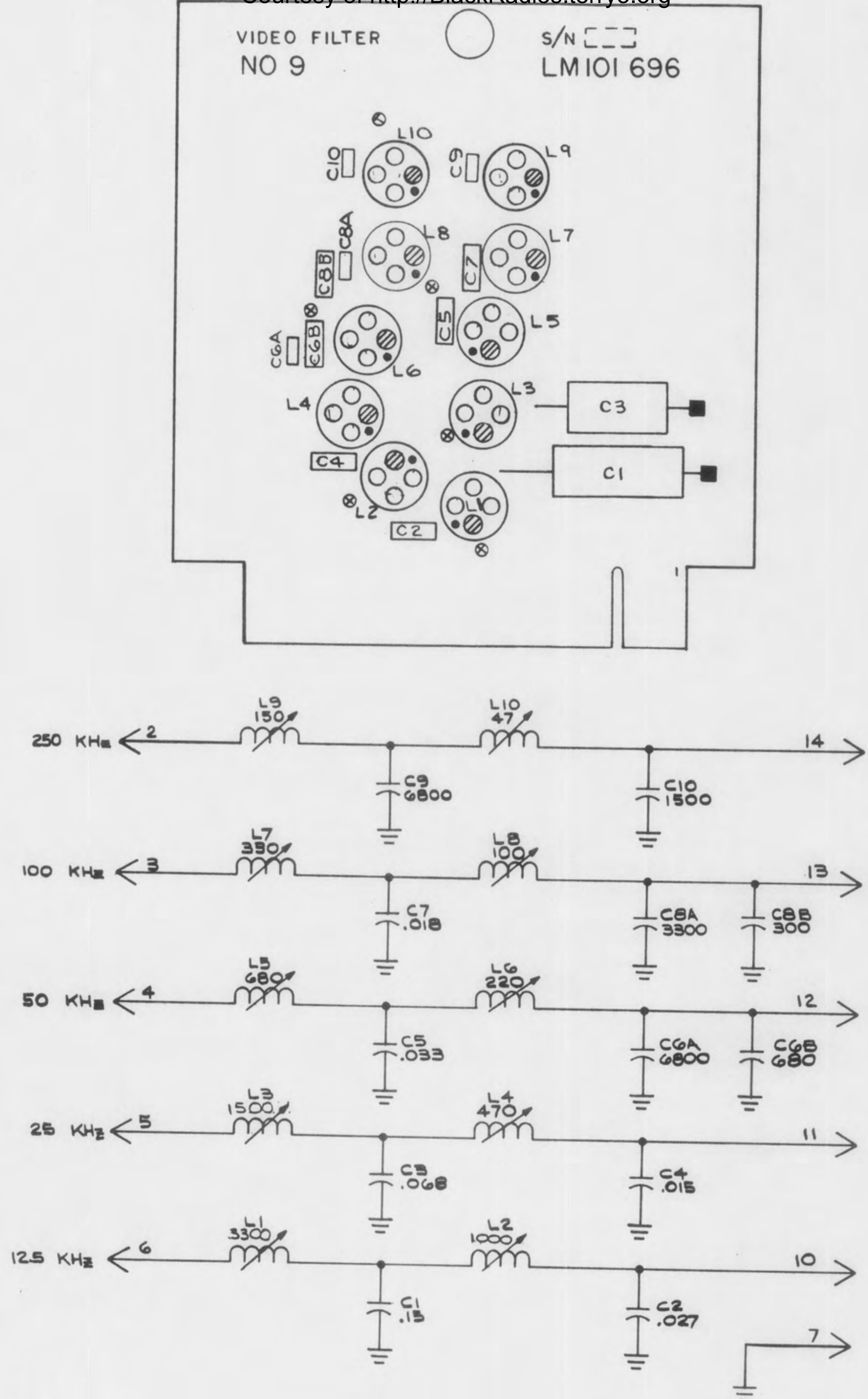


Figure 7-8. Video Filter #9 Schematic/
Assembly Diagram

Rev. December 1984

Instruction Booklet

300-004/300-005
VOLTAGE REGULATORS

February 1973

TRADE SECRETS

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
Telephone (301) 762-8500

VOLTAGE REGULATORS

GENERAL

The 300-004 and 300-005 voltage regulators are designed for use in Microdyne equipment requiring ±15V and ±6V regulated sources. These regulators are in the form of two separate plug-in printed circuit cards which are held in place in the parent unit by module clips. A parent unit may be equipped with one or both regulators or it may use only one portion of the regulator circuitry depending on the specific power requirements. This booklet provides operational information for both regulators and should be adapted for use with the equipment for which it is supplied.

INSTALLATION

No specific installation procedures are required for the positive and negative regulator boards since these modules are normally supplied as part of a parent unit. Reference should be made to the REPAIR section of the parent unit instruction manual for any unique installation procedures. Each regulator module consists of a single printed circuit card. All interface connections are made through the card edge connector. Refer to Figure 1 for the location of the different components.

THEORY OF OPERATION

Since the positive and negative regulators are identical except for the polarity differences of the transistors, diodes and polarized capacitors, only the positive supply is discussed in the following paragraphs. The schematic diagrams for the regulators are shown in Figures 2 and 3.

The positive regulator shown in Figure 2 consists of a +15V regulator circuit and a +6V regulator circuit. The +15V regulator is composed of differential amplifier Q2-Q4, buffer Q1 and current limiter Q3, which function to control the parent unit series regulator connected between pins 2, 3 and 5. The +15V level is set by R9 which determines the bias of Q2, the reference level of the differential is determined by zener diode CR2 and buffer Q4. Any change in the normal +15V output of the power supply is amplified by Q2 and coupled by buffer Q1 to the base of the series regulator as bias. By controlling the base bias of the regulator, the current flow and the output voltage at the collector are also controlled.

Current limiter Q3 functions to shut the regulator off should the voltage developed by the current drain across the series emitter resistor exceed approximately 600 mV. In the normal state, Q3 is cut off and the regulator is functioning. If the current flow through the emitter resistor of the base unit series regulator becomes high enough to drop approximately 0.6V, Q3 conducts. This action then cuts off the series regulator through Q2 and Q1.

The +6V regulator is composed of differential amplifier Q5-Q6, buffer Q7 and current limiter Q8. Potentiometer R12 is provided as the 6V adjustment and the emitter resistor of the 6V series regulator determines the conduction point of current limiter Q8.

The negative regulator board shown in Figure 3 functions in the same manner as the positive board except that all polarities are reversed.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the positive and negative regulators consist of a visual inspection checking for evidence of overheating and corrosion, and calibration of the voltage controls. These tasks should be performed at six-month intervals.

TROUBLESHOOTING

Due to the interrelationship of components in the regulator circuitry, the recommended method of troubleshooting is to check each individual component for proper operation. Begin by checking the PC board for broken circuit strips and connections. Second, check diodes and transistors for shorts and opens. Last, check resistors, capacitors and potentiometers for proper operation. When checking the components, it may become necessary to disconnect one end from the PC board. In this case, use a medium wattage soldering iron (45 watts) and adequate heat sinks to prevent damage. Avoid excessive heat and pressure on the PC board as this can cause irreparable damage.

The following voltage charts are included to aid in isolating a defective component. When performing the voltage checks, the module should be inserted in the parent unit with a Microdyne 300-423 card extender. The indicated voltages were obtained with an HP412A DC voltmeter and may vary ±10% between modules.

Positive Voltage Regulator

Device	E	B	C
Q1	+20.2	+19.5	+19.1
Q2	+ 8.5	+ 9.2	+18.9
Q3	+20.2	+19.8	+ 9.2
Q4	+ 8.5	+ 9.2	+15.5
Q5	+ 5.4	+ 6.1	+ 7.3
Q6	+ 5.4	+ 6.0	+ 6.0
Q7	+15.0	+14.1	+14.1
Q8	+15.0	+14.8	+ 6.0

Negative Voltage Regulator

Device	E	B	C
Q1	-19.6	-19.0	-18.5
Q2	- 8.4	- 9.0	-18.8
Q3	-19.6	-19.3	- 8.9
Q4	- 8.4	- 9.0	-15.0
Q5	- 5.4	- 6.1	- 7.1
Q6	- 5.4	- 6.0	-14.0
Q7	-14.9	-14.2	-14.0
Q8	-14.9	-14.6	- 6.0

REPAIR

All components in the positive and negative power regulators are considered non-repairable and must be replaced when found defective. For optimum performance, defective components should be replaced with identical items, as described in the Replacement Parts List.

CALIBRATION

The following procedure should be used to calibrate the positive and negative regulators. When calibrating the positive regulator (300-004), all measured voltages will be positive. When calibrating the negative regulator (300-005), all measured voltages will be negative. The calibration procedure requires the following equipment:

DC Voltmeter	HP412A
Oscilloscope	HP180A
Card Extender	Microdyne 300-423

Procedure:

a. With the unit plugged into a parent unit and power applied, connect the HP412A DC voltmeter to the 15 volt output. Adjust R9 for a 15.0 volt meter indication.

b. Disconnect the meter from the 15 volt output and connect it to the 6 volt output. Adjust R12 for a 6.0 volt meter indication.

c. Disconnect the voltmeter.

d. Connect the HP180A oscilloscope to the 15 volt output and check the ripple; it should be less than 2 mV. If greater than 2 mV, replace transistor Q3.

e. Disconnect the oscilloscope from the 15 volt output and connect it to the 6 volt output.

f. Check the ripple; it should be less than 0.2 mV. If out of tolerance, replace transistor Q6.

g. Disconnect all test equipment.

REPLACEMENT PARTS LIST - POSITIVE REGULATOR

Reference Designation	Description
C1	Capacitor, tantalum, 15 µF ±10%, 20V, Sprague CS13BE156K
C2	Capacitor, electrolytic, 68 µF ±20%, 10V, Kemet K68E10
C3	Capacitor, electrolytic, 47 µF ±20%, 15V, Kemet K47E20
C4, C6	Capacitor, electrolytic, 100 µF ±20%, 10V, Kemet K100E10
C5	Capacitor, tantalum, 15 µF ±10%, 20V, Sprague CS13BE156K
C7	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
CR1	Diode, 1N914
CR2	Diode, zener, 9V, 1N937
CR3 thru CR5	Diode, 1N914
Q1	Transistor, Motorola 2N2907
Q2	Transistor, Sprague 2N4384
Q3	Transistor, Sprague 2N4413

Replacement Parts List - Positive Regulator, continued

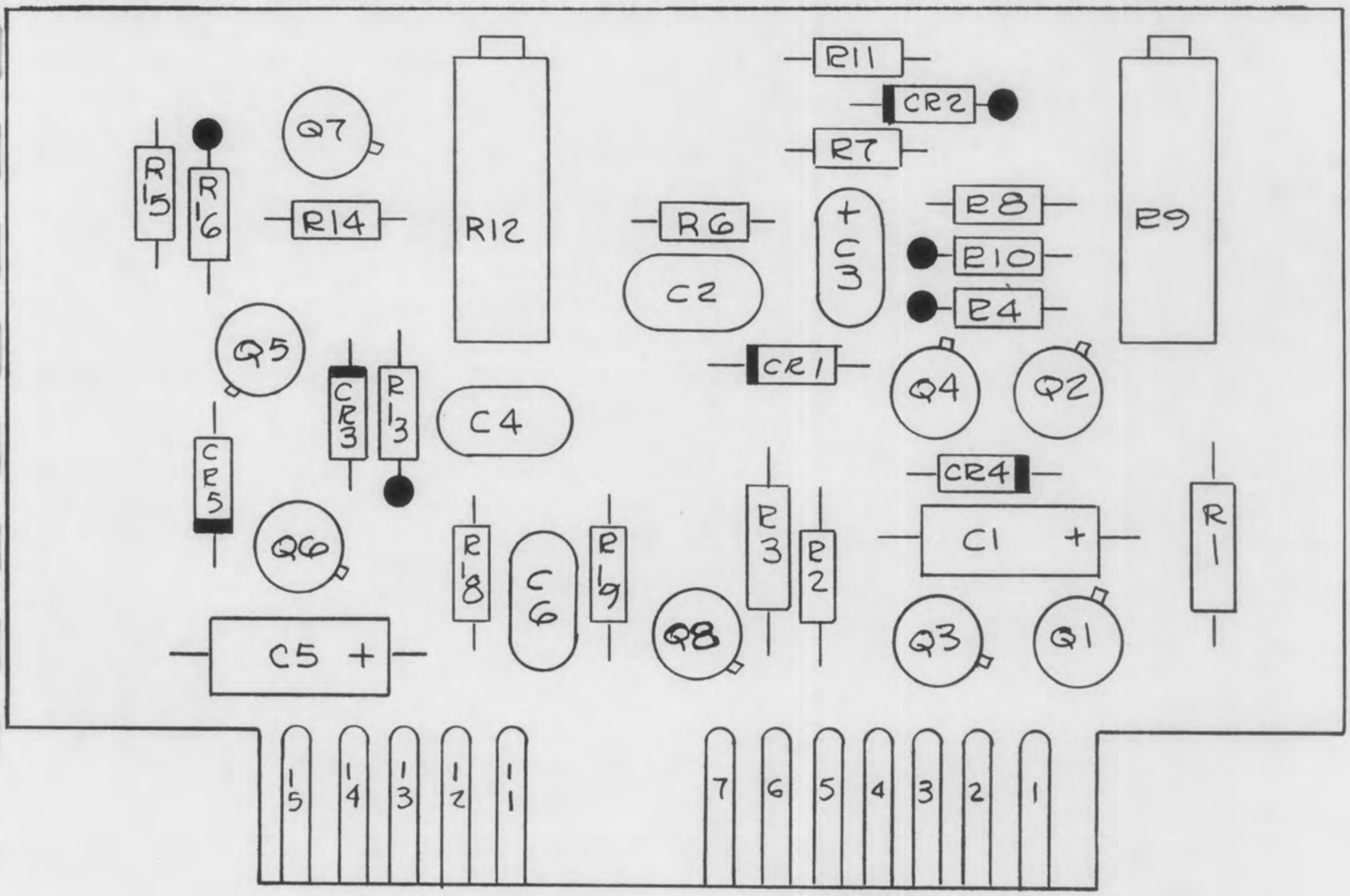
Reference Designation	Description
Q4 thru Q6	Transistor, Sprague 2N4384
Q7	Transistor, Motorola 2N2907
Q8	Transistor, Sprague 2N4413
R1, R3	Resistor, fixed composition, 1.2KΩ ±5%, ½w, Allen Bradley EB1225
R2	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R4	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R5	Not Assigned
R6	Resistor, fixed composition, 820Ω ±5%, ¼w, Allen Bradley CB8215
R7	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R8	Resistor, fixed composition, 1.2KΩ ±5%, ½w, Allen Bradley EB1225
R9, R12	Potentiometer, variable, 500Ω, 3/4w, Beckman 77PR500
R10	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R11	Resistor, fixed composition, 330Ω ±5%, ¼w, Allen Bradley CB3315
R13	Resistor, fixed composition, 910Ω ±5%, ¼w, Allen Bradley CB9115
R14, R15	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R16	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R17	Not Assigned
R18, R19	Resistor, fixed composition, 430Ω ±5%, ¼w, Allen Bradley CB4315

NEGATIVE REGULATOR

Reference Designation	Description
C1, C5	Capacitor, tantalum, 15 µF ±10%, 20V, Sprague CS13BE156K
C2	Capacitor, electrolytic, 68 µF ±20%, 10V, Kemet K68E10
C3	Capacitor, electrolytic, 47 µF ±20%, 20V, Kemet K47E20
C4, C6	Capacitor, electrolytic, 100 µF ±20%, 10V, Kemet K100E10
C7	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
CR1	Diode, 1N914
CR2	Diode, zener, 9V, 1N937
CR3 thru CR5	Diode, 1N914
Q1, Q7	Transistor, Motorola 2N2222
Q2	Transistor, Sprague 2N4413
Q3, Q8	Transistor, Sprague 2N4384
Q4 thru Q6	Transistor, Sprague 2N4413
R1, R3	Resistor, fixed composition, 1.2KΩ ±5%, ½w, Allen Bradley EB1225
R2	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R4	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R5	Not Assigned
R6	Resistor, fixed composition, 820Ω ±5%, ¼w, Allen Bradley CB8215
R7	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R8	Resistor, fixed composition, 1.2KΩ ±5%, ½w, Allen Bradley EB1225
R9, R12	Potentiometer, variable, 500Ω, 3/4w, Beckman 77PR500

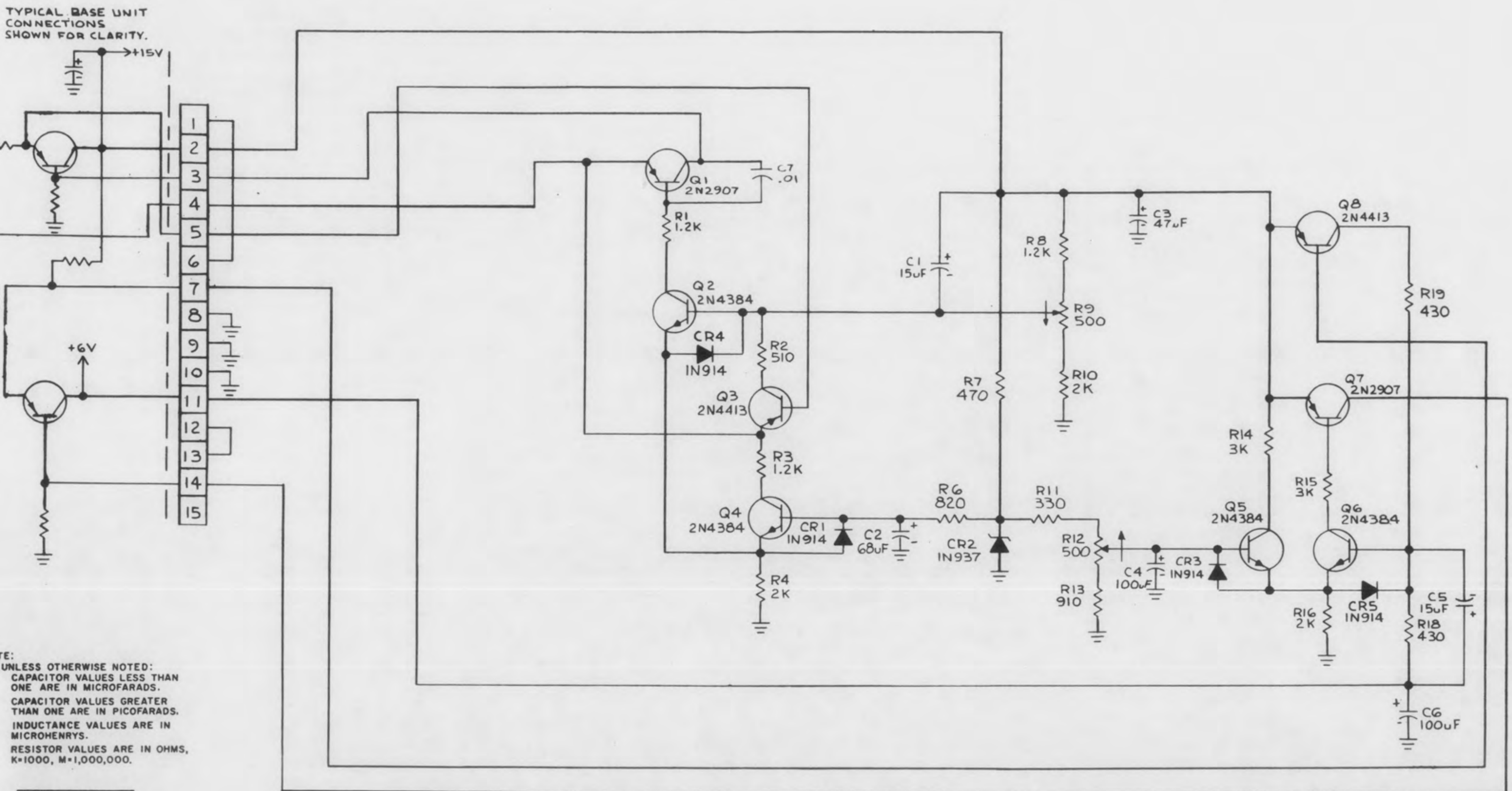
Replacement Parts List - Negative Regulator, continued

Reference Designation	Description
R10, R16	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R11	Resistor, fixed composition, 330Ω ±5%, ¼w, Allen Bradley CB3315
R13	Resistor, fixed composition, 910Ω ±5%, ¼w, Allen Bradley CB9115
R14, R15	Resistor, fixed composition, 3KΩ ±5%, ¼w, Allen Bradley CB3025
R17	Not Assigned
R18, R19	Resistor, fixed composition, 430Ω ±5%, ¼w, Allen Bradley CB4315



NOTE:
Reverse diode and capacitor polarizations for the negative regulator PC board.

Figure 1. Positive Regulator Component Location Diagram



TE:
UNLESS OTHERWISE NOTED:
- CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
- CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
- INDUCTANCE VALUES ARE IN MICROHENRYS.
- RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

HIGHEST REFERENCE DESIGNATION USED			
C7			
CR5			
Q8			
R19			
REFERENCE DESIG NOT USED			
R5			
R17			

Figure 2. Positive/Negative Voltage Regulator Schematic Diagram

NOTE
Except for transistor polarity, schematic diagrams for the positive and negative regulators are identical.

Rev. December 1984

Instruction Booklet

100-086
SECOND LOCAL OSCILLATOR
Serial No. 501 and above

October 1972

TRADE SECRETS

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850

SECOND LOCAL OSCILLATOR

GENERAL

The 100-086 second local oscillator is designed for use with Microdyne telemetry receivers and functions to generate a 60 MHz signal for application to the associated second mixer. The design of this unit permits the selection of any one of five modes of operation. These modes are: VFO, AFC, PM (Automatic Phase Control), XTAL or OFF (external input). A schematic diagram is shown in Figure 2.

INSTALLATION

The module is composed of a printed circuit card mounted in a wraparound metal housing which plugs into a receptacle in the parent receiver. All signal and power connections are made to the receiver through a single connector located on the bottom of the module. Since the module can be installed in various receiver chassis, any installation procedures are presented in the overall receiver instruction manual REPAIR procedures.

THEORY OF OPERATION

The second local oscillator consists of voltage controlled oscillator (VCO) Q1 and associated circuitry, buffer amplifier Q2 and integrated circuit U1 which performs both the crystal oscillator and the output amplifier functions. This module provides the 60 MHz injection signal to the associated second mixer module for conversion of the first IF signal to the second IF signal.

The 60 MHz output is generated from either the crystal oscillator or the voltage controlled oscillator (VCO) depending on the position of the parent unit mode switch. Four modes of operation plus an OFF mode are available: crystal (XTAL), VFO, AFC or PM. In the XTAL mode, power (15V DC) is applied to the crystal oscillator, its buffer amplifier and the output amplifier circuit via P1-9. In the VFO, AFC or PM mode, the power (-15V DC) is removed from the crystal oscillator circuits and applied to the VCO circuits via P1-10.

In the crystal mode, -15V DC is applied to pins 3 and 4 of U1 biasing it on. Integrated circuit U1 is made up of four silicon NPN transistors on a common substrate with two isolated and two with a common base to the emitter terminal. One of the isolated transistors is connected to pins 3, 4 and 5 and is the active circuit in the crystal oscillator. The second isolated transistor is connected as a buffer amplifier of which pin 6 is the input and pin 8 is the output.

The output amplifier portion of U1, which is also used for VCO operation, has an input at pin 9 and the output at pin 1. Pin 2 of this amplifier is the monitor output and is made available at P1-A2, through matching network C37, L9 and C38.

In the VFO mode, -15V DC is applied to transistor Q1 through pin 10 of the subassembly and removed from pins 3 and 4 of U1. Q1 is operated as a 60 MHz oscillator capable of being shifted ±250 KHz by use of a fine tuning control mounted in the parent unit front panel or demodulator module. Fine tuning is accomplished by varying the voltage applied to the cathode of voltage variable capacitor CR3 through pin 6 and potentiometer R1. The output of transistor Q1 is fed to buffer amplifier Q2 and then to the amplifier section of U1.

In the AFC mode, operation of the VCO is identical to the VFO mode except the control voltage from the receiver AFC circuitry is applied to the cathode of voltage variable capacitor CR4 via potentiometer R2 for oscillator frequency control. The output of the oscillator is varied up or down as required to maintain the output frequency of the second mixer at 10 MHz.

In the PM mode, operation of the VCO is essentially the same as the AFC mode except the control voltage applied to CR4 is derived from the phase detector in a phase demodulator.

An external input connection is provided at P1-A3 for injection of a 60 MHz signal from an external source to the second mixer. This input is used when the receiver second LO mode switch is set to the OFF position. The signal must be at a level of at least -13 dBm.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the second local oscillator consists of a semiannual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry: crystal oscillator, buffer amplifier, VCO and output amplifier. This is accomplished by using normal signal tracing methods. Once the defective circuit is found, the faulty component should be located and replaced. The voltage chart in Table 1 is provided to aid in fault isolation. Voltage levels were measured with an HP412A voltmeter and may vary ±10% between units.

Table 1. Voltage Chart

Device	E	B	C	Case
Q1	-1.1	-0.4	0.8	0
Q2	-0.7	0	+6	0

Device	1	2	3	4	5	6	7	8	9	10	11	12
U1 (VFO mode)	-7	-6.2	0	0	0	-9.6	-10.4	0	-5.5	0	0	0
U1 (XTAL mode)	-7	-6.2	-5	5.6	0	-9.6	-10.4	0	-5.5	0	0	0
CR5	-6.2											

REPAIR

All components used in the second LO module are non-repairable and must be replaced when found defective. A list of replaceable components is given in this booklet and a recommended procedure for replacing components mounted on a printed circuit board is given in the parent unit REPAIR section.

ALIGNMENT

After the fault has been located and corrected, the module should be realigned.

The test equipment necessary for alignment is as follows:

Extender Module	Microdyne 300-355
Frequency Counter	HP5245L
DC Voltmeter	HP412A
Power Supply, Dual	HP6205B
Broadband Sampling Voltmeter	HP3406A

a. Connect the second local oscillator module to the parent unit through extender module.

b. Place the front panel 2ND LO MODE switch to the XTAL position.

c. Connect the HP5245L frequency counter to the receiver second LO monitor.

d. Adjust C26 and C28 for exactly 60 MHz as indicated on the counter, with the maximum possible output.

e. Place the front panel 2ND LO MODE switch to VFO. Set the receiver or FINE TUNE control to the center of its range.

f. Adjust C11 for 60 MHz.

g. Set the FINE TUNE control to the maximum clockwise position.

h. Set R1 for a frequency of 300 KHz on one side of 60 MHz.

i. Set the FINE TUNE control to the maximum counterclockwise position and check the frequency of the oscillator. The frequency should be 300 KHz on the opposite side of 60 MHz.

j. Remove the wire from pin 8 of test cable at the module end and connect the external positive power supply between pin 8 and ground on the module.

k. Set the power supply to +5V DC as indicated on the HP412A.

l. Set R2 for a frequency of exactly 60.250 MHz.

m. Set power supply to -5V DC and check frequency. It should be exactly 59.750 MHz.

n. Connect the HP3406A sampling voltmeter to the second LO monitor at the rear panel of the parent unit.

o. Place the 2ND LO MODE switch in the XTAL position.

p. Check the output power; it should be approximately -13 dBm.

q. Place the mode switch in VFO and check the indication on the HP3406A; it should be approximately the same.

REPLACEMENT PARTS LIST

The following replacement parts list provides the reference designation, description, manufacturer and manufacturer's part number for each electrical component used in the second local oscillator.

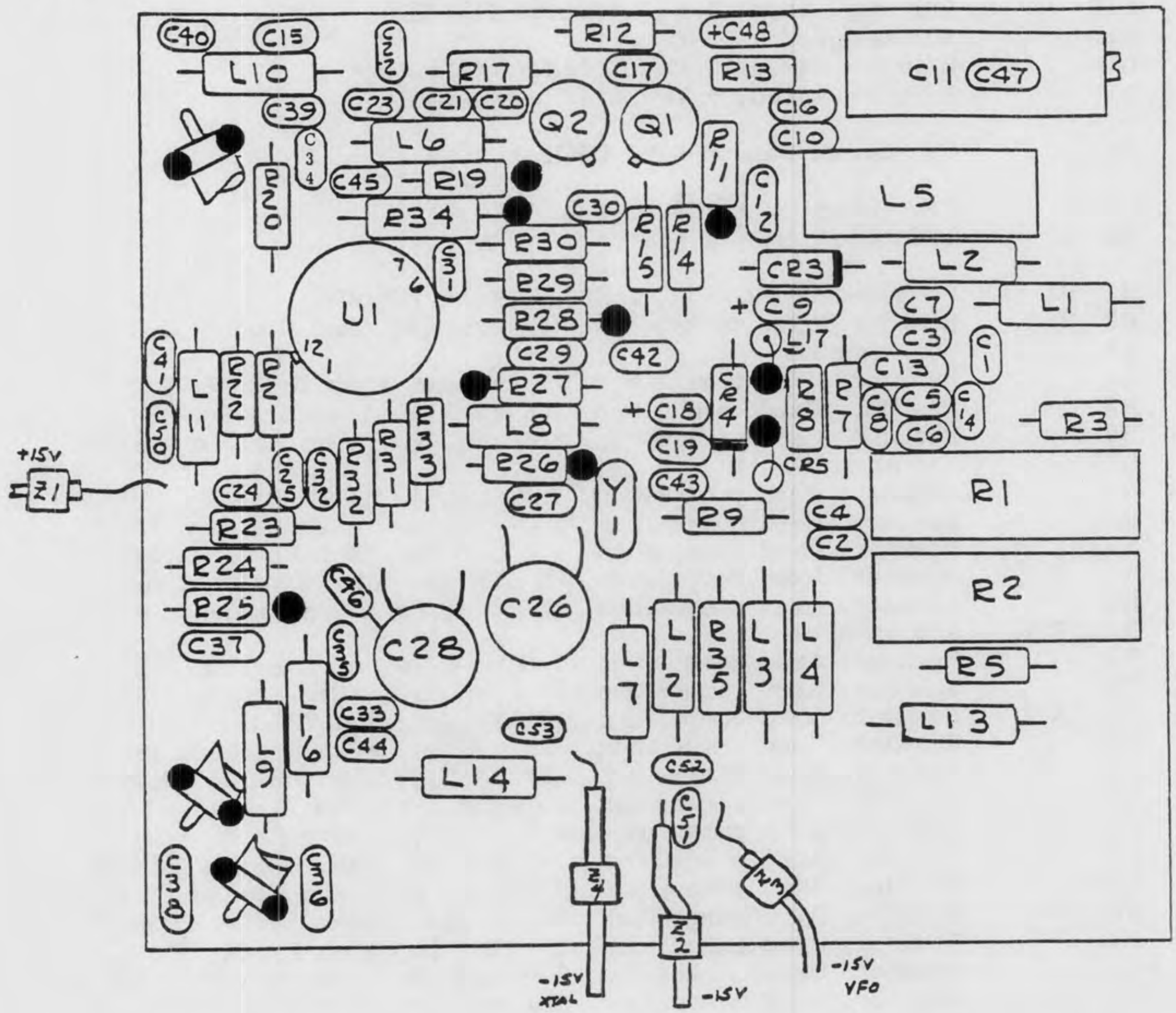
Reference Designation	Description
C1, C2	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C3, C4	Capacitor, ceramic, 7.5 pF ±0.50 pF, 100V, Erie 8101-100-COG-759D
C5	Capacitor, ceramic, .001 µF ±5%, 100V, Erie 8121-100-COG-102J
C6	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, ceramic, 3 pF ±0.1 pF, 100V, Erie 8101-100-COG-309B
C8	Capacitor, ceramic, .001 µF ±5%, 100V, Erie 8121-100-COG-102J
C9	Capacitor, tantalum, 47 µF ±20%, 20V, Kemet T362C476M020AS
C10	Capacitor, ceramic, 5.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-519C
C11	Capacitor, variable, 0.5-6.0 pF, Voltronics QP-6G
C12	Capacitor, ceramic, 62 pF ±5%, 100V, Erie 8121-100-COG-620J
C13	Capacitor, ceramic, 100 pF ±5%, 100V, Erie 8131-100-COG-101J
C14	Capacitor, ceramic, .001 µF ±5%, 100V, Erie 8121-100-COG-102J
C15 thru C17	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C18	Capacitor, tantalum, 47 µF ±20%, 20V, Kemet T362C476M020AS
C19, C20	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C21	Capacitor, ceramic, 3 pF ±0.1 pF, 100V, Erie 8101-100-COG-309B
C22	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C23	Capacitor, ceramic, 6.2 pF ±0.25 pF, 100V, Erie 8101-100-COG-629C
C24, C25	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C26, C28	Capacitor, variable, 0.4-4.5 pF, Voltronics TF5A
C27	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C29 thru C34	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C35 thru C38	Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8131-100-COG-470J
C39	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C40	Capacitor, ceramic, 62 pF ±5%, 100V, Erie 8121-100-COG-620J
C41 thru C45	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C46	Capacitor, ceramic, 5.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-519C
C47	Capacitor, ceramic, 5 pF ±0.25 pF, 250V, Erie CC20UJ050C
C48	Capacitor, tantalum, 47 µF ±20%, 20V, Kemet T362C476M020AS
C49	Capacitor, ceramic, 7.5 pF ±0.5 pF, 100V, Erie 8101-100-COG-759D
C50 thru C53	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
CR1, CR2	Not Assigned
CR3, CR4	Diode, voltage variable capacitance, Microdyne 301-476-1
CR5	Diode, zener, 6.2V, Motorola 1N825A

Replacement Parts List, continued

Reference Designation	Description
L1	Inductor, fixed, 0.68 μH, Jeffers 4425-4K
L2, L3	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L4	Inductor, fixed, 0.68 μH, Jeffers 4425-5K
L5	Inductor, variable, glass PC, 0.30 μH, LRC 681430
L6	Inductor, fixed, 2.2 μH, Jeffers 4425-10K
L7, L9	Inductor, fixed, 0.22 μH, Jeffers 4415-2M
L8	Inductor, fixed, 0.47 μH, Jeffers 4425-2M
L10	Inductor, fixed, 0.27 μH, Jeffers 4416-6K
L11, L12	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L13	Inductor, fixed, 4.7 μH, Jeffers 4425-14K
L14	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L15	Not Assigned
L16	Inductor, fixed, 0.22 μH, Jeffers 4415-2M
L17	Inductor, fixed, 0.33 μH, Jeffers 4425-1M
P1	Connector, Cannon DBM-13W3P
Q1	Transistor, RCA 2N5179
Q2	Transistor, RCA 2N5180
R1, R2	Potentiometer, cermet, 25KΩ, Beckman 77PR25K
R3, R5	Resistor, fixed composition, 15K ±5%, ¼w, Allen Bradley CB1535
R4, R6	Not Assigned
R7	Resistor, fixed composition, 2K ±5%, ¼w, Allen Bradley CB2025
R8	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R9	Resistor, fixed composition, 820Ω ±5%, ¼w, Allen Bradley CB8215
R10	Not Assigned
R11	Resistor, fixed composition, 5.6K ±5%, ¼w, Allen Bradley CB5625
R12	Resistor, fixed composition, 2.7K ±5%, ¼w, Allen Bradley CB2725
R13	Resistor, fixed composition, 75Ω ±5%, ¼w, Allen Bradley CB7505
R14, R17	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R15	Resistor, fixed composition, 750Ω ±5%, ¼w, Allen Bradley CB7515
R16, R18	Not Assigned
R19	Resistor, fixed composition, 5.1K ±5%, ¼w, Allen Bradley CB5125
R20	Resistor, fixed composition, 9.1K ±5%, ¼w, Allen Bradley CB9125
R21, R22	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R23	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905
R24	Resistor, fixed composition, 27Ω ±5%, ¼w, Allen Bradley CB2705
R25	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R26	Resistor, fixed composition, 4.7K ±5%, ¼w, Allen Bradley CB4725
R27	Resistor, fixed composition, 18Ω ±5%, ¼w, Allen Bradley CB1805
R28	Resistor, fixed composition, 9.1K ±5%, ¼w, Allen Bradley CB9125
R29, R30	Resistor, fixed composition, 3K ±5%, ¼w, Allen Bradley CB3025
R31	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R32	Resistor, fixed composition, 6.2K ±5%, ¼w, Allen Bradley CB6225
R33	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R34	Resistor, fixed composition, 240Ω ±5%, ½w, Allen Bradley EB2415, nominal value
R35	Resistor, fixed composition, 1.3K ±5%, ¼w, Allen Bradley CB1325

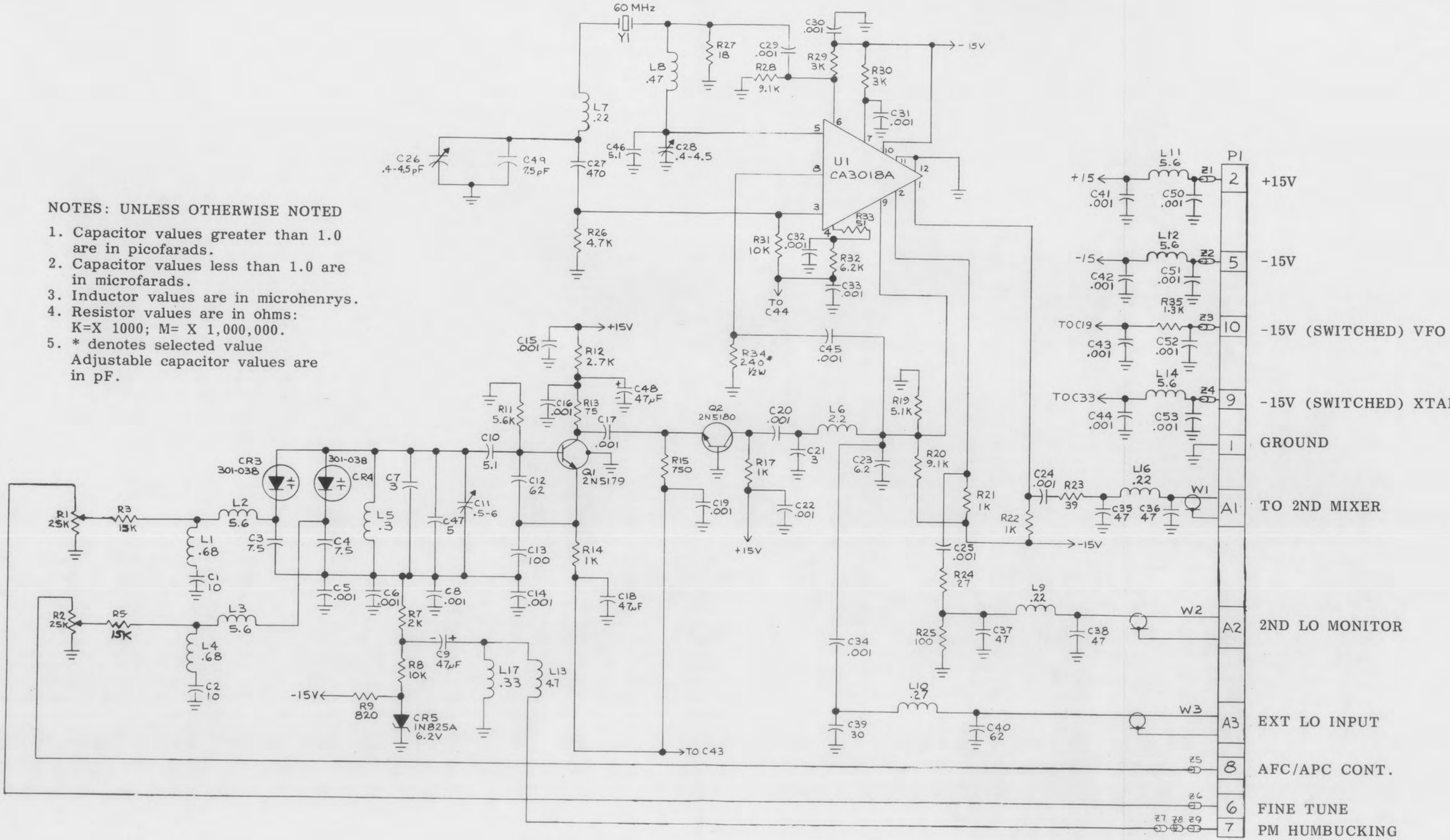
Replacement Parts List, continued

Reference Designation	Description
U1	Integrated Circuit, RCA CA3018A
W1	Cable Assembly, Microdyne 201-983-9
W2	Cable Assembly, Microdyne 201-983-5
W3	Cable Assembly, Microdyne 201-985-5
Y1	Crystal, quartz, 60.000 MHz, Piezo CR-80/U
Z1 thru Z9	Ferrite Bead, Fair Rite 2673000101



NOTE: CR3 and CR4 mounted on rear of board.

Figure 1. Component Location Diagram



NOTES: UNLESS OTHERWISE NOTED

1. Capacitor values greater than 1.0 are in picofarads.
2. Capacitor values less than 1.0 are in microfarads.
3. Inductor values are in microhenrys.
4. Resistor values are in ohms: K=X 1000; M= X 1,000,000.
5. * denotes selected value
   Adjustable capacitor values are in pF.

Figure 2. Second Local Oscillator Schematic Diagram

Rev. October 1986

Instruction Booklet

103-097
SECOND MIXER

January 1977

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
Telephone (301) 762-8500

SECOND MIXER

DESCRIPTION

The 103-097 Second Mixer is designed for use in Microdyne telemetry receivers and is utilized to heterodyne the 50 MHz 1st IF signal with the 60 MHz output of the second local oscillator. The result is the 10 MHz second IF signal. An input is also provided on the module to permit recorded signals to be injected for predetection playback operation of the receiver.

Reference Figure 3, schematic diagram. The 60 MHz local oscillator signal (E3) is coupled to the base of input amplifier Q1. The output circuit of Q1 is tuned to 60 MHz by L11. The signal is routed to limiter/amplifier U1. Here the signal is limited to a level of approximately -20 dB. From the limiter, the signal is coupled through a tuned circuit and a resistive attenuator (R28-R29-R30) to the mixer U2.

The 50 MHz IF signal (E2) is applied through a 70 MHz notch filter for image injection and then through T1 and associated circuit which is used for impedance notching. Q3 and Q4 amplify the IF signal which is applied through a second impedance notching network and a resistive attenuator (R14-R18-R19) to the mixer U2.

The output of the mixer is applied through a lowpass filter designed to remove any of the 60 MHz oscillator signal that may be present. The resultant 10 MHz signal is made available at P1A3 of the module.

The circuitry consisting of Q2, CR1-CR3, is employed to shape the AGC voltage (from the receiver) for use by gain-controlled amplifiers Q3 and Q4.

INSTALLATION

The module is composed of a printed circuit card mounted in a wraparound metal housing which plugs into a receptacle in the parent receiver. All signal and power connections are made to the receiver through a single connector located on the bottom of the module. Since the module can be installed in various receiver chassis, any installation procedures are listed in the overall receiver instruction manual REPAIR procedures.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the second mixer consist of a semi-annual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components. Any discrepancies should be corrected by component replacement or module substitution.

RECOMMENDED TEST EQUIPMENT

The following equipment is recommended for servicing and maintaining the mixer module.

Extender Card	300-356
Frequency Counter	HP5245L
Signal Generator (2)	HP606A
Sweep Generator	Texscan VS-50
RF Detector	HP8471A
Power Supply	HP6205B
Oscilloscope	HP1202A
RF Millivoltmeter	HP3406A w/50 ohm Tee or HP411A
DC VTVM	HP412A
VSWR Kit	Telonix TRK-2A
50 ohm Termination	HP908A
Test Cable	Microdyne 200-729

TROUBLESHOOTING

In the event of a malfunction, the trouble must first be isolated to a certain section of the module circuitry. This is best accomplished by using normal signal tracing methods. Once the defective circuit is located, the faulty component can then be detected and replaced.

Refer to Figure 1 for the component location drawing of the second mixer.

REFERENCE DATA

-0.5V AGC	0 dB gain nominal
-5.0V AGC	6 dB gain nominal
Input Signal Range	-16 dBm to thermal noise

ALIGNMENT/TEST

The following procedures should be conducted after any repairs to the module and may be used to troubleshoot the module whenever a fault is suspected.

a. The receiver is used as the test bed for the module. Remove the cover from the module and install it in the receiver through the extender module 300-356. Remove modules A5 (2nd Local Oscillator), A4 (1st IF Filter), A18 (Playback Converter) and A7 (2nd IF Amplifier) from the receiver.

b. Set the AGC on the parent receiver to the MANual mode and adjust the manual gain control fully counter-clockwise.

c. Apply power to the receiver.

d. Connect one HP606A RF output to the RF input of a frequency counter. With the attenuator set to approximately -10 dBm, adjust the frequency of the HP606A to 60.0 MHz, ±1 KHz. Disconnect the HP606A RF output from the counter and reconnect it to E3 on the module printed

Alignment/Test, continued

d. circuit board. This input may be made through A1 of XA5 (2nd LO) using a 200-729 test cable. Set the attenuator to approximately -50 dBm.

NOTE

This RF level is well below that required for limiting and will give a useful indication of tuning.

e. Place the open probe (unterminated) of the HP3406A RF millivoltmeter directly on junction of R29 and R30 on the module.

f. Adjust L11 and L12 for maximum indication on the RF millivoltmeter.

g. Increase the output level of the HP606A connected to E3 (XA5-A1) to -20 dBm and note the level measured with the RF millivoltmeter (+7 to +9 dB).

h. Connect the test equipment as follows:

Sweep Generator: Video In - through HP8471A RF Detector to E4 or XA7-2
Scope V, Scope H - Corresponding inputs on oscilloscope

Signal Generator #1: 50.000 MHz RF out to E2 or XA4-A3
Signal Generator #2: 60.000 MHz RF out to E3 or XA5-A1

i. Adjust the Texscan VS-50 sweep generator to sweep 50 MHz and set its attenuator to 20 dB.

j. Adjust the HP1202A oscilloscope vertical and horizontal gains for a convenient display.

k. Turn ON the 50 MHz marker on the VS-50 sweep generator and adjust L1, L2, L3, L6 and L7 on the second mixer module for maximum vertical deflection of the 50 MHz marker.

l. Tune the VS-50 sweep generator to 70 MHz and increase its output by 20 dB and adjust L1 and L2 for a null in the response at 70 MHz.

m. Disconnect the sweep generator and the Signal Generator #1 from the module. Connect the sweep generator to the Rhotector, VID in to DETector Out and RF Out to RF In.

n. Set the switches and controls on the Texscan VS-50 sweep generator, the HP1202A oscilloscope and Rhotector as follows:

Alignment/Test, continued

n. continued

Sweep Generator

Center Frequency	50 MHz	RF Vernier	CCW
Sweep Rate	Line	Attenuation	10 and 1
Sweep Width	Wide	Markers	As needed
ALC	INT		

Oscilloscope

Vertical Sensitivity	0.1 mV/div.
Vertical Coupling	DC
Vertical Cal	CAL
Horizontal Sensitivity	Ext 1V/div.
Horizontal Cal	CAL

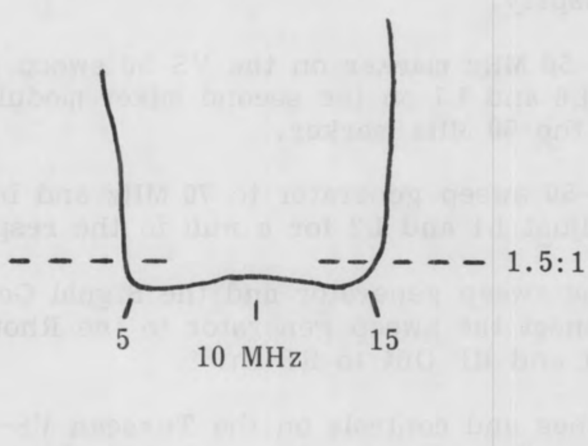
Rhotector

Z1 - Terminated with a 50 ohm termination
Z2 - Terminated with a 1.5:1 termination

o. Adjust the output of the sweep generator to obtain a vertical deflection of two divisions on the oscilloscope. Center 10 MHz and use the 1 MHz marker for a display which is ±6 MHz wide.

p. Unterminate Z2 of the Rhotector and connect it to E4 (XA7-A2) of the module. Adjust L13 for a response as shown below.

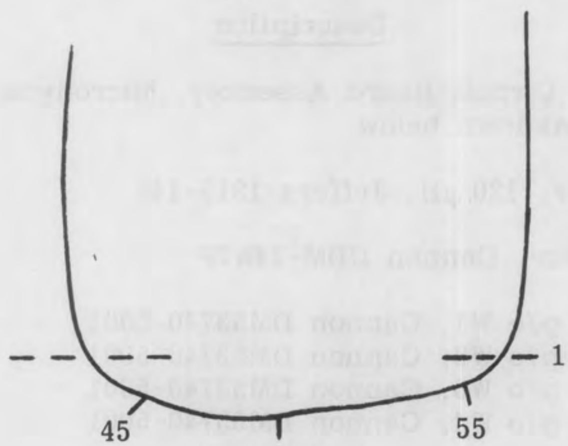
Output VSWR



Alignment/Test, continued

q. Connect Z2 of the Rhotector to A3 of the test fixture. Adjust L3, L7 and L6 for a response as shown below.

Input VSWR



r. Reconnect the equipment as in step h.

s. Adjust L3, L6, L7 and L13 for a 1 dB response of greater than ±5 MHz.

t. Connect a CW signal set to 50 MHz to E2 and the terminated HP3406 millivoltmeter to E4. With -20 dBm input, measure the gain (-1 to +1 dB).

u. Set the AGC control for -5.0 (±0.1)V at the AGC test point. Note the difference between this level and the level obtained in step t. (Gain reduction at -5.0 AGC, -5.0 to 7.0 dB.)

v. Increase the HP606A input level at E2 to -10 dBm. Measure the output at E4. Note the difference between the input level and output level (compression) (-1 to 0 dBm).

w. Disconnect the HP606A from E2 and connect it to the playback input E1 (XA18-A3). Terminate E2 with a 50 ohm load. Set the HP606A output level to 0 dBm and note the output level (transfer loss) (-30 to -22 dB).

This completes test and alignment of the Second Mixer module. Remove power from the receiver and disconnect the test equipment. Reinstall the modules in the receiver.

REPLACEABLE PARTS LIST

The following replaceable parts list provides the reference designation, description, manufacturer and manufacturer's part number for each electrical component used in the 103-097 Second Mixer. Include all information when ordering spare or replaceable components.

MODULE HOUSING

Reference Designation	Description
A1	Printed Circuit Board Assembly, Microdyne 103-098; see breakdown below
L1 thru L3	Inductor, 120 µH, Jeffers 1315-14J
P1	Connector, Cannon DDM-24W7P
P1A1	Insert, p/o W1, Cannon DM53740-5001
P1A3	Insert, p/o W2, Cannon DM53740-5001
P1A5	Insert, p/o W3, Cannon DM53740-5001
P1A7	Insert, p/o W4, Cannon DM53740-5001
W1	Cable Assembly, Microdyne 202-858-4
W2	Cable Assembly, Microdyne 202-858-3
W3	Cable Assembly, Microdyne 202-858-5
W4	Cable Assembly, Microdyne 202-858-6
Z1 thru Z3	Ferrite Bead, Fair-Rite 267-3000-101

A1, Printed Circuit Board Assembly (103-098)

Reference Designation	Description
C1, C2	Capacitor, ceramic, 4.3 pF ±.25 pF, 100V, Erie 8101-100-COG-439C
C3	Capacitor, ceramic, 130 pF ±5%, 100V, Erie 8121-100-COG-131J
C4	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8121-100-COG-390J
C5	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C6	Capacitor, ceramic, 330 pF ±5%, 100V, Erie 8121-100-COG-331J
C7 thru C15	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C16	Capacitor, ceramic, 24 pF ±5%, 100V, Erie 8121-100-COG-240J
C17, C18	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C19	Capacitor, ceramic, 43 pF ±5%, 100V, Erie 8121-100-COG-430J
C20 thru C22	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C23, C24	Capacitor, ceramic, 27 pF ±5%, 100V, Erie 8121-100-COG-270J
C25, C26	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C27	Capacitor, ceramic, 3.9 pF ±.25 pF, 100V, Erie 8101-100-COG-399C
C28	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8111-100-COG-150J
C29	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C30, C32	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C31	Capacitor, ceramic, 13 pF ±5%, 100V, Erie 8111-100-COG-130J

A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
C33	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8121-100-COG-910J
C34	Capacitor, tanatlum, 4.7 pF ±20%, 20V, Kemet T362B475M020AS
C35	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C36	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C37	Capacitor, ceramic, 24 pF ±5%, 100V, Erie 8121-100-COG-240J
C38, C39	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
CR1 thru CR3	Diode, JEDEC 1N914
E1 thru E4	Termination, p/o PC Board
E5 thru E8	Termination, AMP 61067-1
L1, L2	Inductor, variable, 1.0 µH, Cambion 7107-13
L3	Inductor, variable, .15 µH, Cambion 7107-03
L4	Inductor, fixed, 1.5 µH ±10%, Jeffers 4425-8K
L5	Inductor, fixed, 4.7 µH ±10%, Jeffers 4425-14K
L6, L7	Inductor, variable, .47 µH, Cambion 7107-09
L8 thru L10	Inductor, fixed, 4.7 µH ±10%, Jeffers 4425-14K
L11, L12	Inductor, variable, .33 µH, Cambion 7107-7
L13	Inductor, variable, .56 µH, Cambion 7107-10
Q1	Transistor, NPN, RCA 2N5179
Q2	Transistor, PNP, RCA 2N4957
Q3, Q4	Transistor, NPN, Motorola 2N5031
R1	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R2	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605
R3	Resistor, fixed composition, 680Ω ±5%, ¼w, Allen Bradley CB6815
R4	Resistor, metal film, 1.0K ±1%, 1/8w, QPL RN55D1001F
R5	Resistor, fixed composition, 110Ω ±5%, ¼w, Allen Bradley CB1115
R6	Resistor, fixed composition, 910Ω ±5%, ¼w, Allen Bradley CB9115
R7	Resistor, fixed composition, 4.3K ±5%, ¼w, Allen Bradley CB43G5
R8	Resistor, fixed composition, 680Ω ±5%, ¼w, Allen Bradley CB6815
R9 thru R11	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R12	Resistor, fixed composition, 36K ±5%, ¼w, Allen Bradley CB3635
R13	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R14	Resistor, fixed composition, 5.6K ±5%, ¼w, Allen Bradley CB5625
R15	Resistor, fixed composition, 22Ω ±5%, ¼w, Allen Bradley CB2205
R16	Resistor, fixed composition, 560Ω ±5%, ¼w, Allen Bradley CB5615
*R17	Resistor, fixed composition, 36Ω ±5%, ¼w, Allen Bradley CB3605
*R18, *R19	Resistor, fixed composition, 150Ω ±5%, ¼w, Allen Bradley CB1515
R20	Resistor, fixed composition, 680Ω ±5%, ¼w, Allen Bradley CB6815
R21	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R22, R23	Resistor, fixed composition, 15K ±5%, ¼w, Allen Bradley CB1535
R24	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R25	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005

* nominal value

A1, Printed Circuit Board Assembly, continued

Reference Designation	Description
R26	Resistor, fixed composition, 2K ±5%, ¼w, Allen Bradley CB2025
R27	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
*R28	Resistor, fixed composition, 91Ω ±5%, ¼w, Allen Bradley CB9105
R29	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R30	Resistor, fixed composition, 620Ω ±5%, ¼w, Allen Bradley CB6215
R31	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R32	Resistor, fixed composition, 3.6K ±5%, ¼w, Allen Bradley CB3625
R33	Resistor, fixed composition, 1.6K ±5%, ¼w, Allen Bradley CB1625
R34	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
T1	Transformer, Microdyne 203-352
U1	Operational Amplifier, RCA CA3028
U2	Mixer, Minicircuits Lab. Div. SRA-1
Z1, Z2	Ferrite Bead, Fair-Rite 267-3000-101
Z3, Z4	Ferrite Bead, Fair-Rite 9820-1

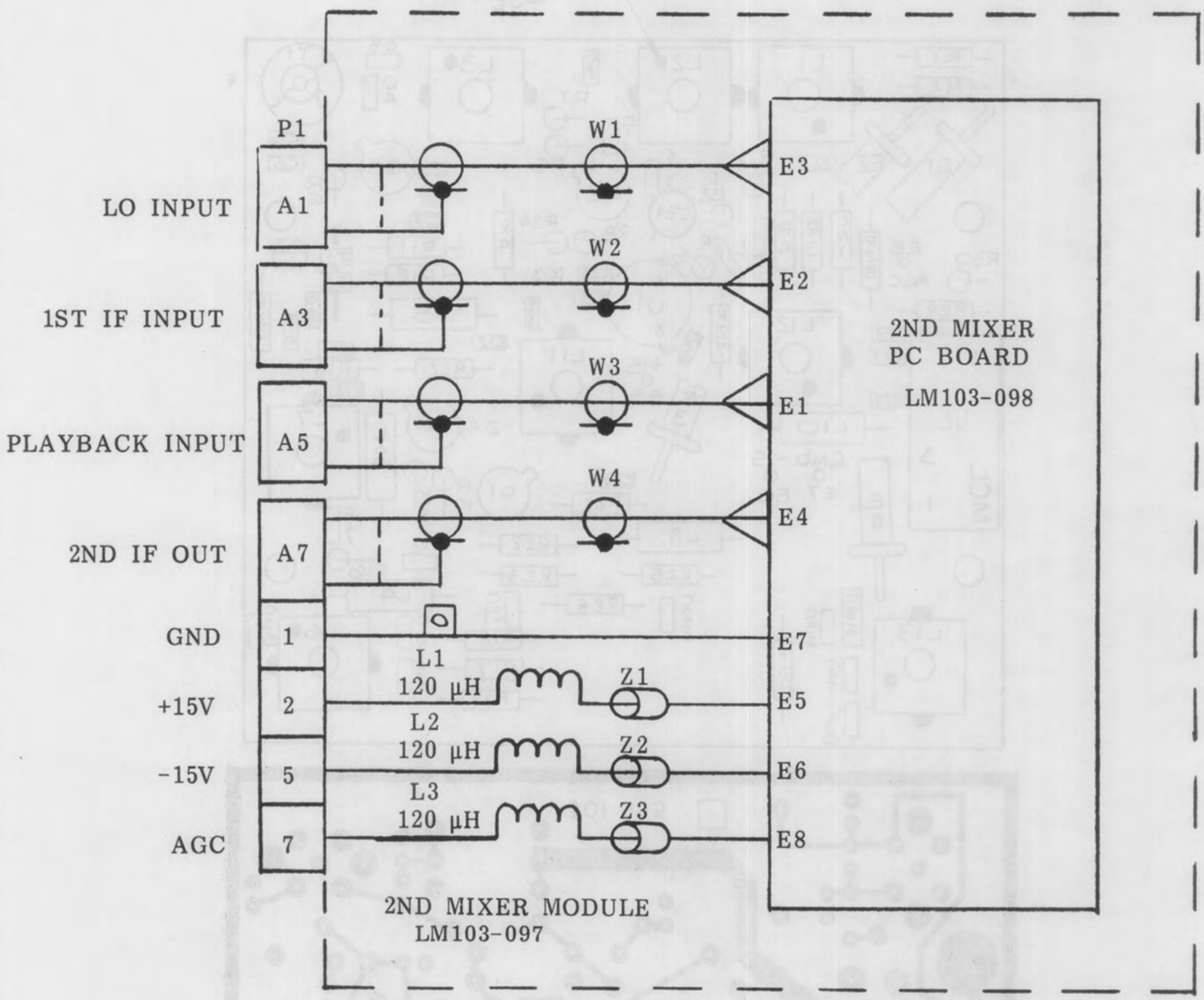


Figure 1. Module Wiring Diagram

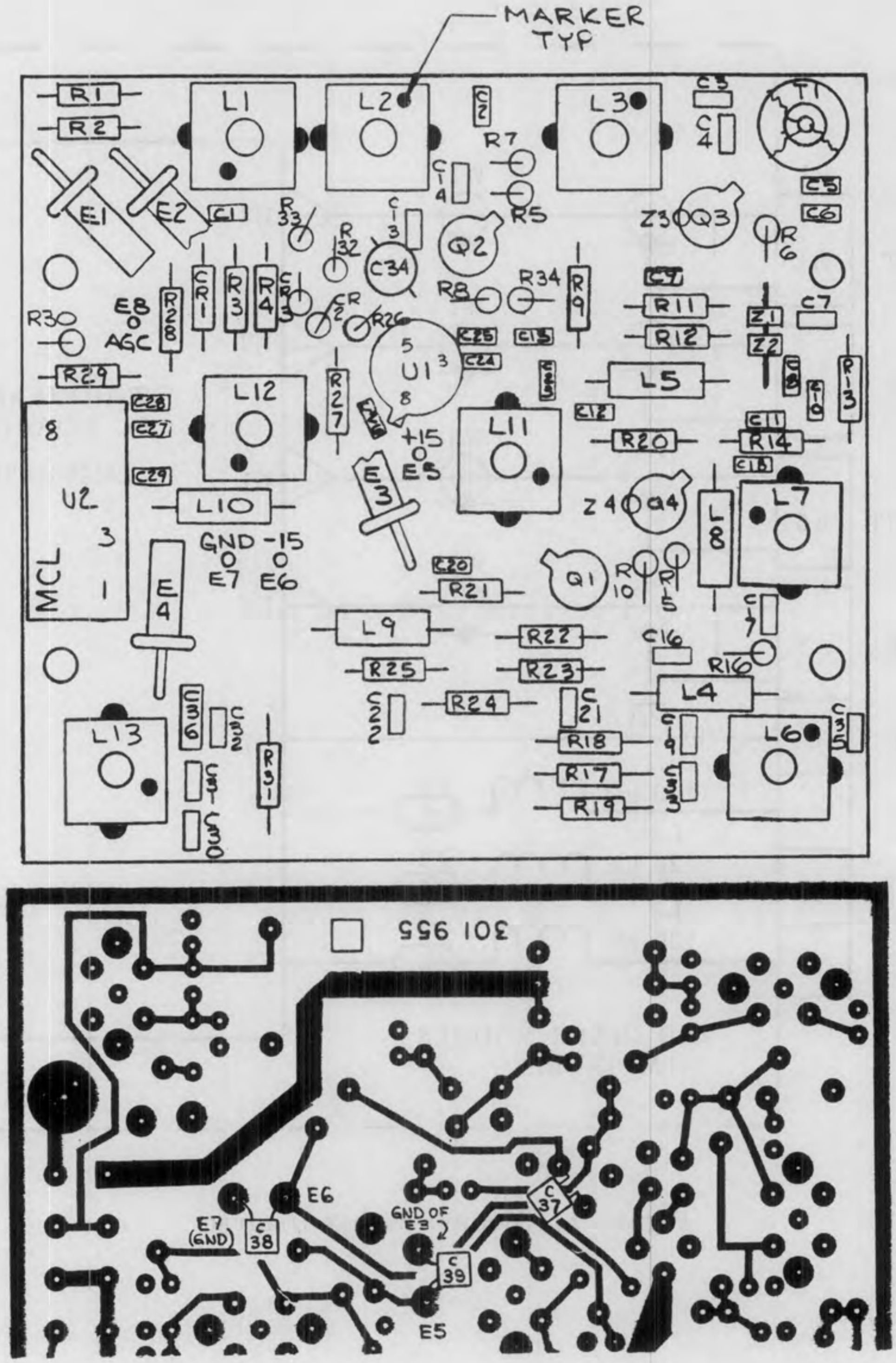


Figure 2. Component Location Drawing

HIGHEST REFERENCE DESIGNATION USED			
C37	CR3	E8	L13
Q4	R34	T1	U2
Z4			
REFERENCE DESIG. NOT USED			

NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. * DENOTES SELECTED VALUE.
6. —⊖— FERRITE BEAD.

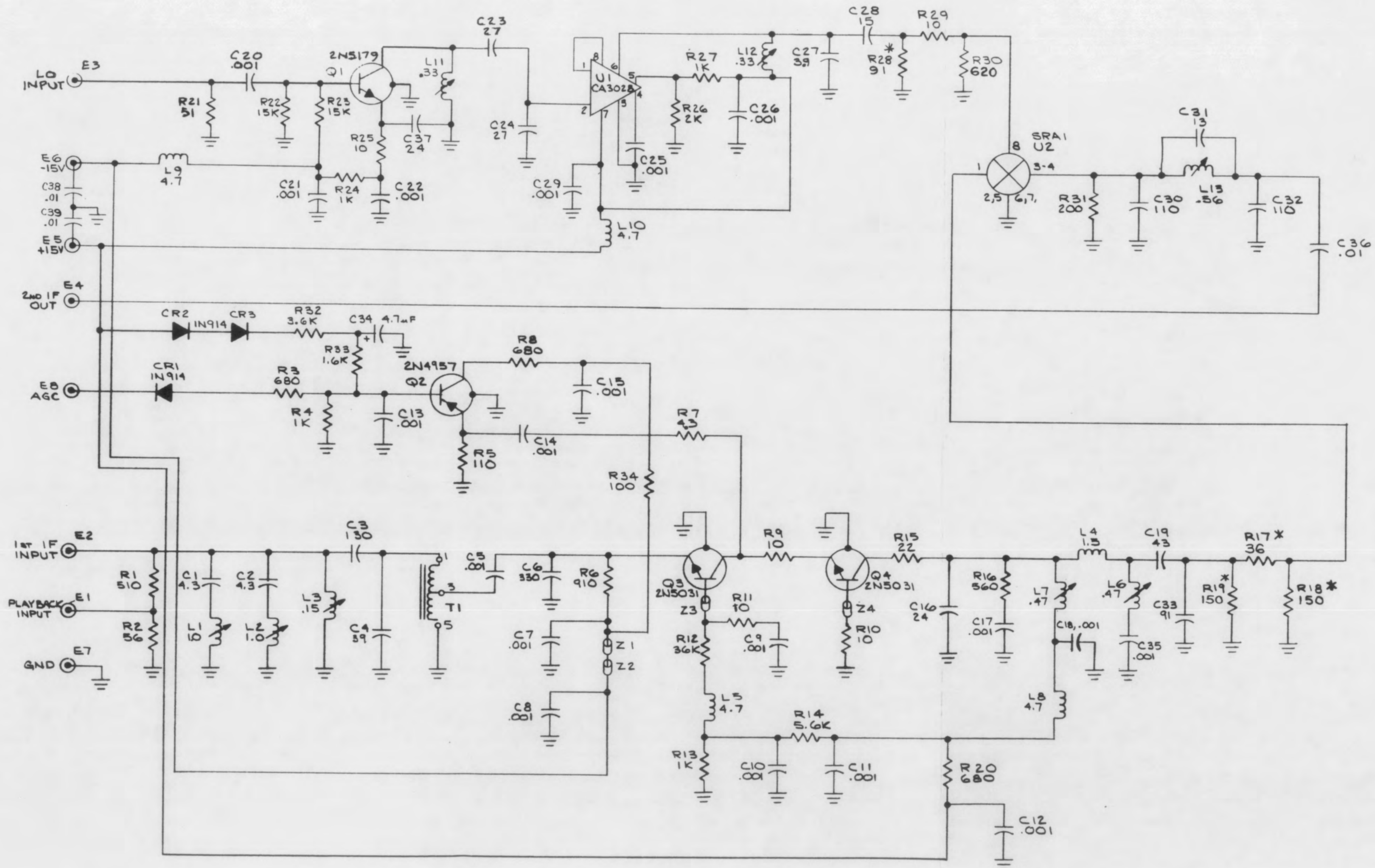


Figure 3. Second Mixer Schematic Diagram

Rev. December 1984

Instruction Booklet

100-090
AM DETECTOR

December 1972

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
Telephone (301) 762-8500

AM DETECTOR

GENERAL

The AM Detector is designed for use with Microdyne telemetry equipment and performs the following functions: it detects AM signals, provides gain control voltage to the AGC Amplifier, and provides amplified, limited and linear 10 MHz IF outputs for recording and/or combining equipment. A schematic diagram of the AM Detector is shown in Figure 2.

INSTALLATION

No definite installation procedures can be applied to the AM detector since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedures.

The AM detector is constructed on a printed circuit board and enclosed in a metal housing which plugs into a parent unit receptacle. Refer to Figure 1 for component location.

THEORY OF OPERATION

The AM detector consists of integrated circuit amplifiers U1, U2, U3, transistor driver Q1, and integrated circuit limiter U4. These stages function to provide an AM video output, a high impedance AM detected output, an AGC sensor signal and amplification of the 10 MHz for application to the demodulator. The module also supplies a 10 MHz linear output and a 10 MHz limited output.

Integrated circuit U1 consists of four silicon epitaxial transistors, two of which are isolated and two of which are connected in a Darlington configuration for emitter follower operation. The 10 MHz carrier is coupled through C1 to the first isolated transistor U1Q1, amplified, and applied to the second isolated transistor U1Q2. The amplified signal is fed to driver Q1 through C16. Negative feedback is used in this stage to improve stability and linearity. The Darlington transistors in U1 operate as a buffer amplifier to supply a 10 MHz output to the demodulator module and limiter stage U4. Limiter U4 operates with the first stage of the Darlington amplifier in U2 to provide a 50 mV limited output at P1-A1.

Driver stage Q1 provides sufficient output through transformer T1 to drive the AM detector. The modulated signal is fed to diode detector CR1, CR2, CR3 and CR4, which is operated in a bridge configuration for maximum linearity and sensitivity. Output from the detector is coupled through voltage divider R26 and R27 and low-pass filter C32, L7, C35 and L8. This signal is then applied to buffer amplifier U3Q1. The AM detector high impedance output is taken from the detector and routed to the output at pin 13 via R25.

The AGC sensor voltage is coupled through R28 to buffer amplifier U2Q1 whose output is connected to emitter resistor R31. The output of U2Q2 (an isolated transistor used as a constant current source) is also tied to R31. The output voltage from this stage is fed to the AGC amplifier module and processed to derive the automatic gain control voltage. The 10 MHz post-limited output originating at the emitter of the first transistor of the Darlington in U1, is limited by U2 and applied to pin 9 of U2. The post-limited output is taken from U2-2 and applied to the module output at pin A3.

Theory of Operation, continued

Integrated circuit U3 performs the same way as U2. Isolated transistor U3Q1 is an emitter follower with the output connected to R38. The collector of the second transistor U3Q2 is also tied to R38. A balance control on the parent unit is utilized to set the DC output of this stage to zero volts with no signal input.

The prelimited output also originates at the emitter of the first transistor of the Darlington in U1 and is coupled through C40 to the input at U3-9. Output from this section of U3 is fed to pin A1 of the module.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the AM detector consist of a semi-annual check of the connector for corrosion and loose pins and the module itself for signs of damage and loose components. Any defects noted during the inspection should be corrected at once.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry: buffer amplifier, transformer, diode bridge, LC filter and emitter follower. This is accomplished by using normal signal tracing methods and by comparing the DC voltage levels with those given below. In the event that there is no AM output at either P1-13 or P1-A2, check diodes CR1 through CR4, and transformer T1 for shorted or open conditions. Once the defective circuit has been located, the faulty component should be detected and replaced. A DC voltage chart is given below to aid in fault isolation. Voltages listed may vary ±20% between units.

Device	1	2	3	4	5	6	7	8	9	10	11	12
U1	-5.8	-5	- 0.005	- 0.7	+11.4	-0.6	-1.34	+ 9.4	-4.2	-0.330	0	0
U2	0	-2	-10.8	-11.4	- 3.4	+0.27	-0.42	+14	-1.34	-3.2	0	0
U3	0	-3.5	-13	-13	- 1	+0.33	-0.38	+ 8.8	-2.7	-0.88	0	0
U4	+2.2	+2.2	+ 2.2	+ 2.2	+ 7.8	+1.75	0	0	+0.96	+8		

	E	B	C
Q1	-1.9	-1.3	+15

Refer to Figure 1 for component location of the AM detector.

ALIGNMENT

After the fault has been located and corrected, the module must be realigned. The test equipment necessary for alignment is as follows:

Extender Module	Microdyne 300-355
Signal Generator	HP606A
DC Voltmeter	HP412A

Procedure:

a. Connect the module to the parent unit using the extender module. Remove the preceding second IF filter module.

b. Set the HP606A for a 10 MHz output at -21 dBm and connect it to the 10 MHz output connector on the parent unit second IF filter receptacle.

c. Connect the HP412A P1-13 and adjust R20 for +5V DC. Disconnect the voltmeter.

d. Connect the voltmeter to P1-15 and adjust R24 for +1.5V DC.

e. Disconnect the test equipment. Replace the second IF filter.

f. Install the AM detector and recalibrate the parent unit as required.

REPLACEMENT PARTS LIST

The following replacement parts list provides the reference designation, description, manufacturer and manufacturer's part numbers for each electrical component used in the AM detector.

Reference Designation	Description
C1	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C2	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C3 thru C10	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C11	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C12 thru C26	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C27	Capacitor, ceramic, 56 pF ±5%, 100V, Erie 8131-100-COG-560J
C28	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8121-100-COG-181J
C29	Capacitor, ceramic, 43 pF ±5%, 100V, Erie 8121-100-COG-430J
C30	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C31	Capacitor, ceramic, .0047 µF ±20%, 100V, Erie 8131-100-X5T-472M
C32	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C33	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C34	Capacitor, ceramic, 2700 pF ±20%, 100V, Erie 8131-100-X5R-272M
C35	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8121-100-COG-390J
C36	Not Used
C37 thru C44	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C45	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C46 thru C49	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M

Replacement Parts List, continued

Reference Designation	Description
CR1 thru CR4	Diode, JEDEC 1N277
L1 thru L3	Inductor, fixed, 82 μH ±5%, Jeffers 1315-10J
L4	Not Used
L5	Inductor, fixed, 4.7 μH ±10%, Jeffers 4425-14K
L6	Inductor, fixed, 5.6 μH ±10%, Jeffers 4435-1K
L7	Inductor, fixed, 270 μH ±5%, Jeffers 1331-21J
L8	Inductor, fixed, 200 μH ±5%, Jeffers 1315-19J
L9	Inductor, fixed, 82 μH ±5%, Jeffers 1315-10J
Q1	Transistor, RCA 2N5189
R1	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R2	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R3	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R4	Resistor, fixed composition, 30Ω ±5%, ¼w, Allen Bradley CB3005
R5	Resistor, fixed composition, 4.7K ±5%, ¼w, Allen Bradley CB4725
R6	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R7	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R8, R9	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R10, R11	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R12	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R13	Resistor, fixed composition, 1.5K ±5%, ¼w, Allen Bradley CB1525
R14	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R15, R16	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R17	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R18, R19	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R20	Potentiometer, 5K, 3/4w, Beckman 77PR5K
R21	Resistor, fixed composition, 510Ω ±5%, ½w, Allen Bradley EB5115
R22	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R23	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R24	Potentiometer, 5K, 3/4w, Beckman 77PR5K
R25	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R26, R28	Resistor, fixed composition, 5.1K ±5%, ¼w, Allen Bradley CB5125
R27	Resistor, fixed composition, 2K ±5%, ¼w, Allen Bradley CB2025
R29	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R30	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R31, R32	Resistor, fixed composition, 2.7K ±5%, ¼w, Allen Bradley CB2725
R33, R34	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R35	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R36	Resistor, fixed composition, 4.7K ±5%, ¼w, Allen Bradley CB4725
R37	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R38, R39	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R40	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R41	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905
R42, R44	Resistor, fixed composition, 1.5K ±5%, ¼w, Allen Bradley CB1525
R43, R45	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R46	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905

Replacement Parts List, continued

Reference Designation	Description
R47, R49	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R48	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R50	Resistor, fixed composition, 5.6K ±5%, ¼w, Allen Bradley CB5625
R51	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R52	Resistor, fixed composition, 27K ±5%, ¼w, Allen Bradley CB2735
R53	Resistor, fixed composition, 5.1K ±5%, ¼w, Allen Bradley CB5125
R54, R56	Resistor, fixed composition, 51K ±5%, ¼w, Allen Bradley CB5135
R55	Resistor, fixed composition, 20K ±5%, ¼w, Allen Bradley CB2035
R57	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215
R58 thru R60	Resistor, fixed composition, 100K ±5%, 1/8w, Allen Bradley BB1045
T1	Transformer, Microdyne 200-402
U1 thru U3	Integrated Circuit, RCA CA3018A
U4	Integrated Circuit, RCA CA3012
W1 thru W5	Cable Assembly, Microdyne 300-208
Z1 thru Z6	Ferrite Bead, Fair-Rite 267-3000-101

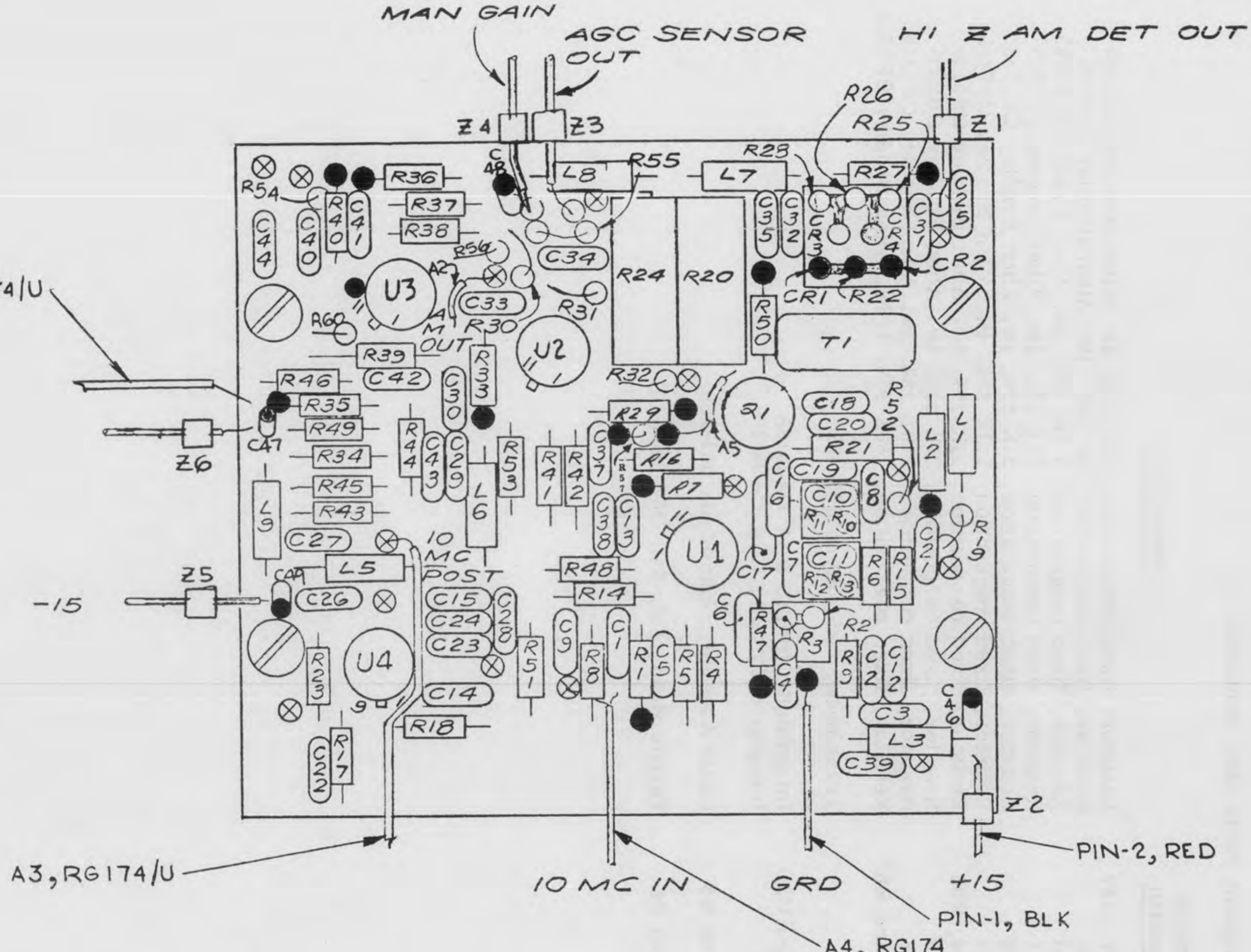


Figure 1. AM Detector Component Location Diagram (300-026)

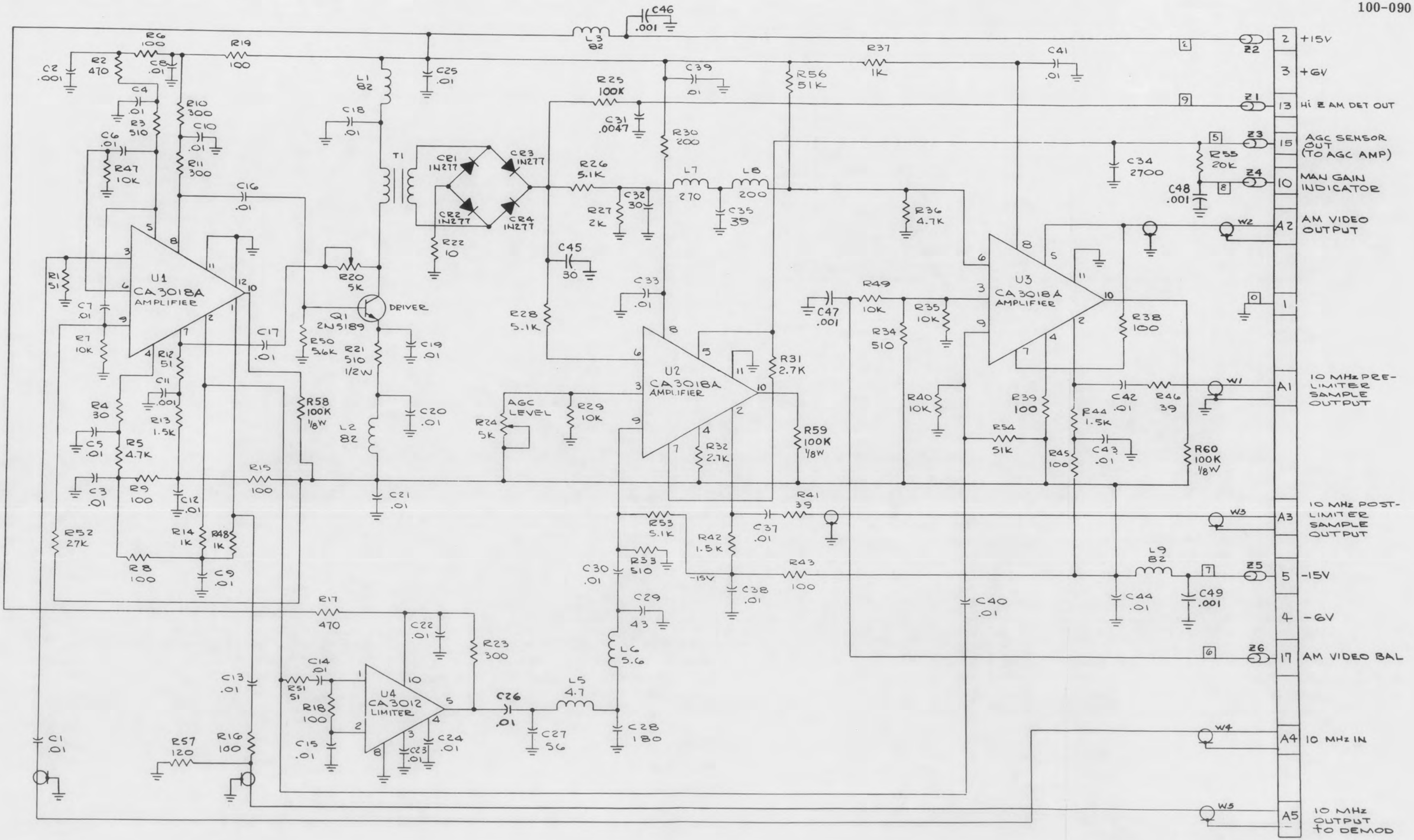


Figure 2. AM Detector Schematic Diagram (400-007)

Rev. June 1980

Instruction Booklet

100-089
CALIBRATION/REFERENCE OSCILLATOR

July 1973

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
Telephone (301) 762-8500

100-089 CALIBRATION/REFERENCE OSCILLATOR

GENERAL

The 100-089 calibration/reference oscillator is designed for use in Microdyne telemetry receivers and playback monitor units. The module generates a 10 MHz (±2 KHz) output signal used in calibrating the parent unit and for reference purposes when the parent unit is equipped with a phase demodulator. A schematic diagram of the oscillator is shown in Figure 2.

INSTALLATION

No specific installation procedures can be applied to the oscillator module since it may be installed in various parent units. Any special installation instructions are given in the parent unit instruction manual REPAIR procedures. All power and signal connections to the module are made through a single miniature connector located on the bottom of the module.

THEORY OF OPERATION

The oscillator circuitry consists of integrated circuit U1 and 10.000 MHz quartz crystal Y1. See Figure 2.

The portion of U1 connected between pins 3, 4 and 5 is used in conjunction with Y1 to generate the stable 10 MHz signal. Inductors L1 and L4 are provided as adjustments to accurately set the output frequency and amplitude. Output from the oscillator is applied to the common base amplifier connected between U1-6, 7 and 8. From pin 8, the 10 MHz signal is applied to the input of a Darlington pair at U1-9. One output of the Darlington is taken from U1-2 and applied to P1-A3 for further application to the parent unit demodulator. The second output is taken from U1-1 and applied to P1-A1 for further application to the parent unit monitor output. Output impedances are 50 ohms and the output levels are approximately -20 dBm.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the oscillator consist of a semi-annual check of the module for signs of damage and loose components, and a check of the output frequency. Any discrepancies noted during the inspection should be corrected immediately. The recommended procedure for correcting any frequency error is to perform the alignment procedure given below.

TROUBLESHOOTING

In the event of a malfunction, the module should be checked to insure that all circuits are receiving operating voltages and that there are no loose connections or components. If there are no visual discrepancies, check the operation of the integrated circuit by comparing the voltages against those given on the next page. The crystal should be checked by substituting a known good spare. After the defective component is located, it should be replaced with an identical part as referenced in the replacement parts list.

DC Voltage Measurements

1	2	3	4	5	6	7	8	9	10	11	12
-7.7	-7	0	-1.1	+14.2	0	-0.72	+2.4	-6.2	0	0	0

ALIGNMENT

The procedure recommended for realigning the oscillator is given below and requires the use of the following equipment:

Frequency Counter	HP5245L
Oscilloscope	HP180A
Extender Module	Microdyne 300-355

a. Remove the module cover and install it in the parent unit using the extender module. Apply power to the parent unit.

b. Connect the frequency counter to the parent unit monitor output.

c. Connect the oscilloscope vertical input, terminated in 50 ohms, to the output end of C11.

d. Adjust L1 and L4 for 10.000 MHz (±2 KHz) at maximum amplitude as displayed on the oscilloscope. The waveform should be symmetrical with a constant amplitude.

e. Adjust L5 for an output level of 150 mV peak-to-peak.

f. Disconnect all test equipment.

REPLACEMENT PARTS LIST

Reference Designation	Description
C1	Capacitor, ceramic, 36 pF ±5%, 100V, Erie 8121-100-COG-360J
C2, C3	Capacitor, ceramic, .01µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C4	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8121-100-COG-390J
C5 thru C8	Capacitor, ceramic, .01µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C9	Capacitor, ceramic, 68 pF ±5%, 100V, Erie 8131-100-COG-680J
C10	Capacitor, ceramic, 2700 pF ±20%, 100V, Erie 8131-100-X5R-272M
C11, C12	Capacitor, ceramic, .01µF ±20%, 100V, Erie 8131-B106-X5VO-103M
L1	Inductor, variable, 6.8µH, Cambion 7107-23
L2, L3	Inductor, fixed, 120µH, Jeffers 1315-14J
L4, L5	Inductor, variable, 6.8µH, Cambion 7107-23
P1	Connector, Cannon DBM13W3P w/two DM53740-1 coaxial inserts
R1	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R2	Resistor, fixed composition, 68K ±5%, ¼w, Allen Bradley CB6835
R3	Resistor, fixed composition, 3K ±5%, ¼w, Allen Bradley CB3025

Replacement Parts List, continued

Reference Designation	Description
R4	Resistor, fixed composition, 2.4K ±5%, ¼w, Allen Bradley CB2425
R5	Resistor, fixed composition, 2K ±5%, ¼w, Allen Bradley CB2025
R6	Resistor, fixed composition, 9.1K ±5%, ¼w, Allen Bradley CB9125
R7	Resistor, fixed composition, 5.1K ±5%, ¼w, Allen Bradley CB5125
R8, R11	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905
R9, R10	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R12	Resistor, fixed composition, 360Ω ±5%, ¼w, Allen Bradley CB3615
U1	Integrated Circuit, RCA CA3018A
Y1	Crystal, 10.000 MHz, Piezo 816-30-07

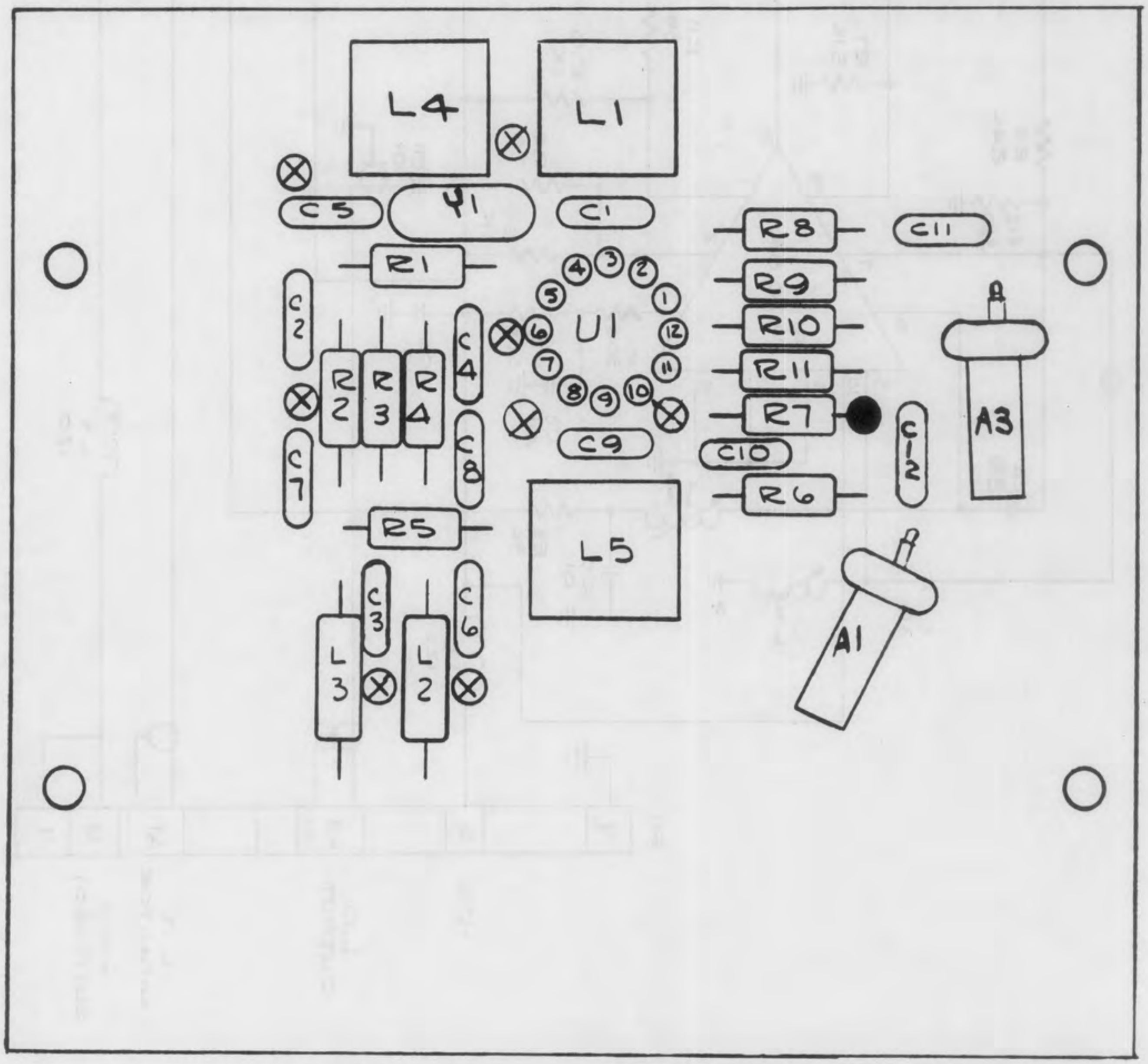


Figure 1. Calibration/Reference Oscillator Module Component Location Diagram

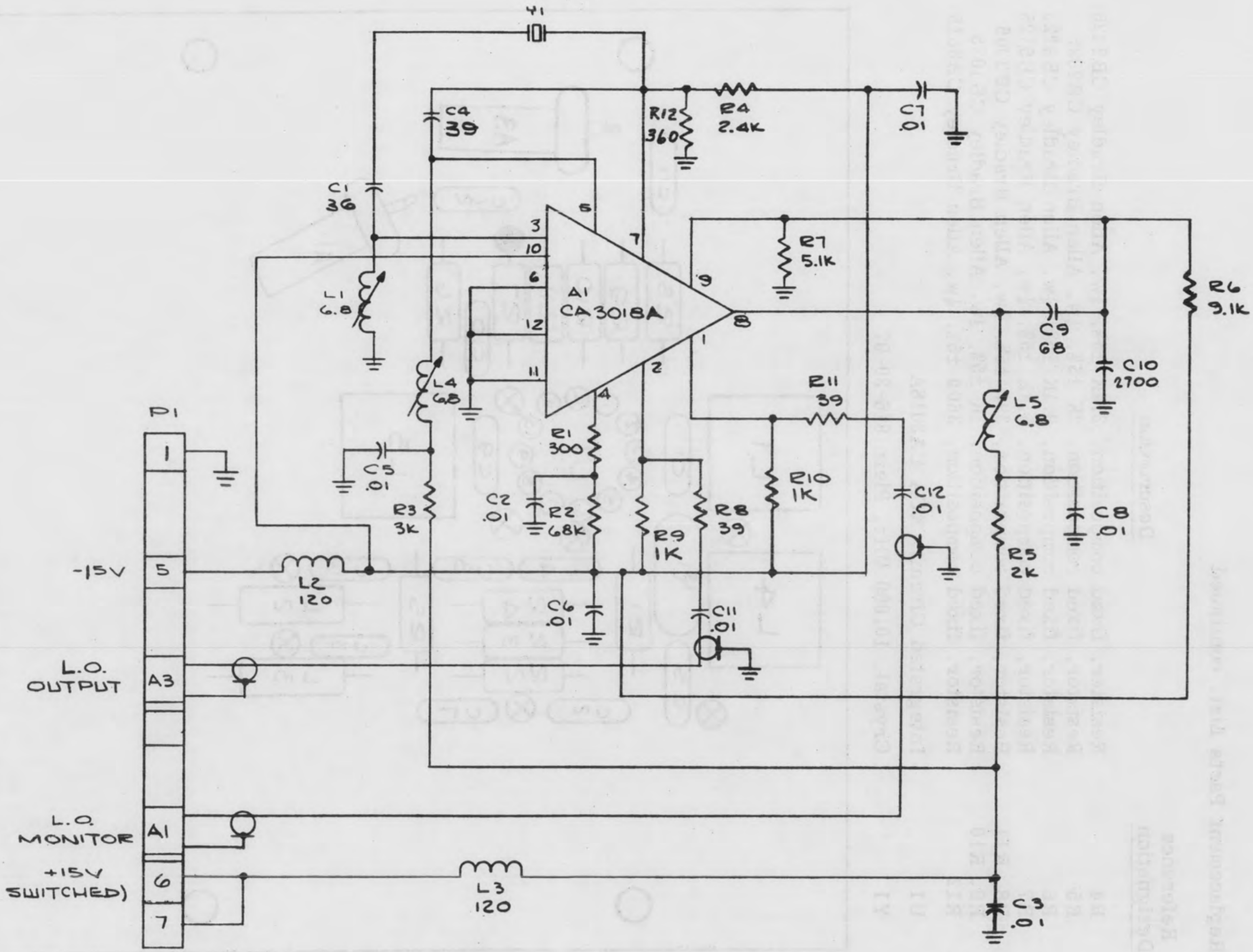


Figure 2. Calibration/Reference Oscillator Schematic Diagram (300-037)

Rev. June 1984

Instruction Booklet

300-054
VIDEO AMPLIFIER

March 1973

TRADE SECRETS

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
Telephone (301) 762-8500

VIDEO AMPLIFIER

GENERAL

The video amplifier is designed for use in Microdyne telemetry and tracking receivers. The unit provides power amplification for both filtered and unfiltered input signals and is used in applications requiring video outputs as high as 10V peak-to-peak; a sample of this output is used to drive the receiver video output meter. Also included on this module is an audio amplifier for driving the speaker on the receiver front panel. A schematic diagram of the module is shown in Figure 2.

INSTALLATION

The video amplifier is constructed as a single printed circuit board having an edge-type connector at one end for mating with a parent receiver receptacle. Since the module can be installed in various parent receivers, no definite installation procedures can be given here. For this reason, reference must be made to the parent unit instruction manual REPAIR procedures for data concerning both installation and removal.

THEORY OF OPERATION

The video amplifier consists of two independent sections, video and audio. The video section employs operational amplifiers U1 and U2, driver Q1-Q2, and power amplifier Q3-Q4 for an output capability of 10V peak-to-peak into a 75 ohm load. The audio section is a monolithic integrated circuit, class B, wide band amplifier with a current of 300 mA into a high impedance, center-tapped speaker.

Operational amplifier U1 is used for low-level amplification. The video signal is directly coupled to the inverting input (U1-2) and amplified by a factor of 39. For optimum performance with a high frequency input, pins 2 and 3 of U1 are frequency compensated by C1 and R2 to permit a full output swing. Pins 5 and 6 are compensated by C3 and for lead-lag frequency compensation. Feedback resistor R6 controls the closed loop gain and CR1 clamps the input driving to a .6V level to prevent overdriving U1. Output from U1 is applied to U2 which operates in the same manner as U1 and also has a gain factor of 39. From U2 the signal is applied to DC coupled driver stage Q1-Q2 which feeds complementary output stage Q3-Q4. Potentiometer R22 is utilized as a DC offset to set the DC output level to zero volts. Two outputs are supplied by Q3-Q4 and are routed to connector pins 5 and 6. The level of the output signal is capable of being set as high as 10V peak-to-peak into 75 ohms and is dependent on the module input level. This level, in turn, is determined by the parent unit video gain control.

U3 is a wide band integrated circuit and consists of a voltage regulator, buffer amplifier, differential amplifier and phase splitter, driver, and power output amplifier on one substrate. The audio signal which is derived from the video output is AC coupled through C16 to the input at U3-10. Outputs are taken from U3-4 and 7 and are connected to the outside terminals of the center-tapped speaker. The audio level is adjusted by the parent unit audio gain control which controls the input level applied to U3-10 via module pin 14.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the video amplifier consist of a semi-annual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry: amplifier U1, amplifier U2, amplifier U3 or transistors Q1, Q2, Q3 and Q4. This is accomplished by applying a 1 KHz 7 mV signal as in the ALIGNMENT procedure and tracing the signal through the module. Once the area of signal loss is determined, check that stage for proper operation. A static DC voltage chart is shown below to assist in troubleshooting.

Table 1. Voltage Chart

Device	1	2	3	4	5	6	7	8
U1	Gnd.	+0.0055	+0.0015	-3.5	+1.8	+0.26	+0.1	+12
U2	0	-0.025	-0.04	-4.1	+2.65	+0.65	-0.87	+12.5
U3	+6.5	+1.05	+1.05	0	0	0	0	+13

Device	9	10	11	12
U3	+13	+7.1	+2.15	0

Device	E	B	C
Q1	- 0.86	- 0.9	-13
Q2	-13.6	-13	- 2.35
Q3	- 2.1	- 2.45	-13.5
Q4	- 2	- 2.35	-13.5

NOTE: Voltages measured under "no signal" conditions using an HP412A or 414A DC voltmeter. Voltages listed may vary 10% between units.

Reference Data

Gain: X200 minimum (46 dB) referenced to input Pins 2 or 3 with 75 ohm video output load, at 1 KHz input frequency.

Rated Output: 4V p-p into 75 ohms (1.4V rms).

REPAIR

After determining the component at fault, that component is to be replaced with an identical part as referenced in the REPLACEMENT PARTS LIST. Information for replacing components mounted on printed circuit boards is given in the parent unit instruction manual REPAIR procedures.

After repairs have been made, the unit should be aligned and tested prior to use to ensure proper operation. Test equipment for alignment and test consists of:

Extender Card	Microdyne 300-423
DC Voltmeter	HP412A or 414A
Test Oscillator	HP651B
Distortion Analyzer	HP334B

Procedure:

a. Remove the parent receiver demodulator.

b. Install the video amplifier under test into the applicable receiver receptacle using the extender card. Apply power to the receiver.

c. Set the receiver VIDEO BANDWIDTH KHz control to the OUT position to bypass all filtering. Set the VIDEO COUPLING switch to DC. Set the VIDEO GAIN control fully clockwise.

d. Ground pin 2 of the video amplifier using a short cliplead.

e. Connect the DC voltmeter to pin 6 of the amplifier card and adjust R22 for 0.0V DC.

f. Disconnect the ground from pin 2 and connect it to pin 3. Observe that the voltmeter indicates a DC level of not more than ±200 mV. If greater than ±200 mV, recheck the adjustment of R22. If the problem cannot be corrected, check, and if necessary, replace U1 and U2.

g. Disconnect the voltmeter and the short.

h. Connect the HP334A distortion analyzer to the receiver video output connector using a 75 ohm termination. Set the analyzer for voltmeter operation.

i. Connect the HP651B 50 ohm output to XA9-A2 (demodulator connector) through an L-pad consisting of a 68 ohm, 1/2w, 5% shunt resistor (on generator side) and series 75 ohm, 1/2w, 5% resistor (XA9-A2 side). Set the HP651B for a 1 KHz output at 13 mV as indicated on the HP651B output meter. Observe the voltage indicated on the HP334A distortion analyzer; it should be greater than 1.4V rms.

j. Reduce the level of the 1 KHz input signal until the video output level is exactly 1.4V rms.

Procedure, continued

k. Measure the distortion; it should be less than 0.5%. If distortion is above 0.5%, check the HP651B test oscillator by itself. It should be no greater than 0.2% or it may contribute significantly to the video amplifier output distortion.

l. Set the HP334A for voltmeter operation and increase the HP651B output until the analyzer meter indicates +15 dB on video output level; this is the reference level.

m. Increase the HP651B output frequency to 2 MHz and observe the video output level; it should have changed no more than ±1 dB.

n. Increase the frequency until the output level is 3 dB less than the level observed in step l. Observe the HP651B frequency; it should be greater than 2.5 MHz.

o. Reset the HP651B to 1 KHz at 13 mV rms. Set the receiver VIDEO COUPLING switch to AC. Observe that the video output is approximately 1.4V rms.

p. With the 1 KHz, 13 mV input applied, turn the receiver AUDIO GAIN control clockwise. An audible tone should be heard from the speaker. If not, check U3 for proper operation.

q. Disconnect all test equipment.

REPLACEMENT PARTS LIST

Reference Designation	Description
C1, C5	Capacitor, ceramic, 130 pF ±5%, 100V, Erie 8121-100-COG-131J
C2, C4	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8121-100-X5R-103M
C3, C7	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C6, C8	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8121-100-X5R-103M
C9	Capacitor, ceramic, 56 pF ±5%, 100V, Erie 8131-100-COG-560J
C10, C11	Capacitor, tantalum, 47 µF, 20V, Kemet K47-E20
C12, C15	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8121-100-X5R-103M
C13, C14	Capacitor, tantalum, 47 µF, 20V, Kemet K47-E20
C16, C19	Capacitor, tantalum, 1 µF, 20V, Sprague 150D105X9020A2
C17	Capacitor, paper film, .1 µF, Sprague 192P1049R8
C18	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8121-100-X5R-103M
C20	Capacitor, tantalum, 47 µF, 20V, Kemet K47-E20
C21, C22	Capacitor, tantalum, 150 µF, 6V, Kemet K150-E6
*C23	Capacitor, ceramic, 330 pF ±5%, 100V, Erie 8121-100-COG-331J
CR1 thru CR4	Diode, JEDEC 1N914
L1, L2	Inductor, 82 µF, Jeffers 1315-10J

* nominal value

Replacement Parts List, continued

Reference Designation	Description
Q1	Transistor, Motorola 2N2907
Q2	Transistor, Motorola 2N2222
Q3	Transistor, Motorola 2N2219
Q4	Transistor, Motorola 2N2905
R1 thru R3	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R4	Resistor, fixed composition, 3.9K ±5%, ¼w, Allen Bradley CB3925
R5	Resistor, fixed composition, 620Ω ±5%, ¼w, Allen Bradley CB6215
R6	Resistor, fixed composition, 39K ±5%, ¼w, Allen Bradley CB3935
R7	Resistor, fixed composition, 1.6K ±5%, ¼w, Allen Bradley CB1625
R8	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R9, R10	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
*R11	Resistor, fixed composition, 2K ±5%, ¼w, Allen Bradley CB2025
R12	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R13	Not Used
R14	Resistor, fixed composition, 11K ±5%, ¼w, Allen Bradley CB1135
R15	Resistor, fixed composition, 3.9K ±5%, ¼w, Allen Bradley CB3925
R16	Resistor, fixed composition, 620Ω ±5%, ¼w, Allen Bradley CB6215
R17	Resistor, fixed composition, 39K ±5%, ¼w, Allen Bradley CB3935
R18	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R19	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R20	Resistor, fixed composition, 91Ω ±5%, ¼w, Allen Bradley CB9105
R21	Resistor, fixed composition, 1.5K ±5%, ¼w, Allen Bradley CB1525
R22	Potentiometer, 5K, Beckman 66XR5K
R23	Not Used
R24, R27	Resistor, fixed composition, 30Ω ±5%, ½w, Allen Bradley EB3005
R25, R26	Resistor, fixed composition, 13Ω ±5%, ½w, Allen Bradley EB1305
R28	Resistor, fixed composition, 51Ω ±5%, ½w, Allen Bradley EB5105
R29	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R30	Resistor, fixed composition, 680Ω ±5%, ½w, Allen Bradley EB6815
R31	Resistor, fixed composition, 130Ω ±5%, ½w, Allen Bradley EB1315
R32	Resistor, fixed composition, 1M ±5%, ¼w, Allen Bradley CB1055
R33	Resistor, fixed composition, 1.1K ±5%, ¼w, Allen Bradley CB1125
R34	Resistor, fixed composition, 3.9K ±5%, ¼w, Allen Bradley CB3925
R35	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3025
R36	Resistor, fixed composition, 750K ±5%, ¼w, Allen Bradley CB7545
R37	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
U1, U2	Integrated Circuit, Fairchild µA702C
U3	Integrated Circuit, RCA CA3020

* nominal value

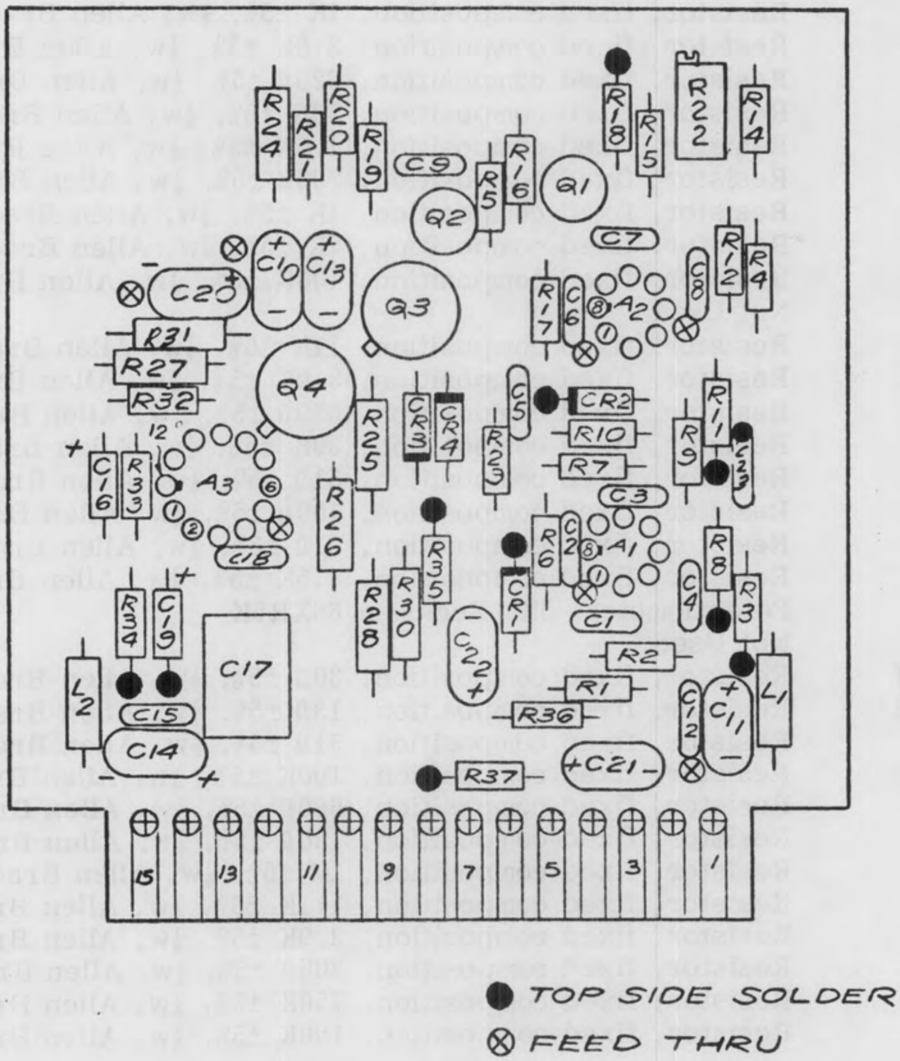


Figure 1. Video Amplifier Component Location Diagram

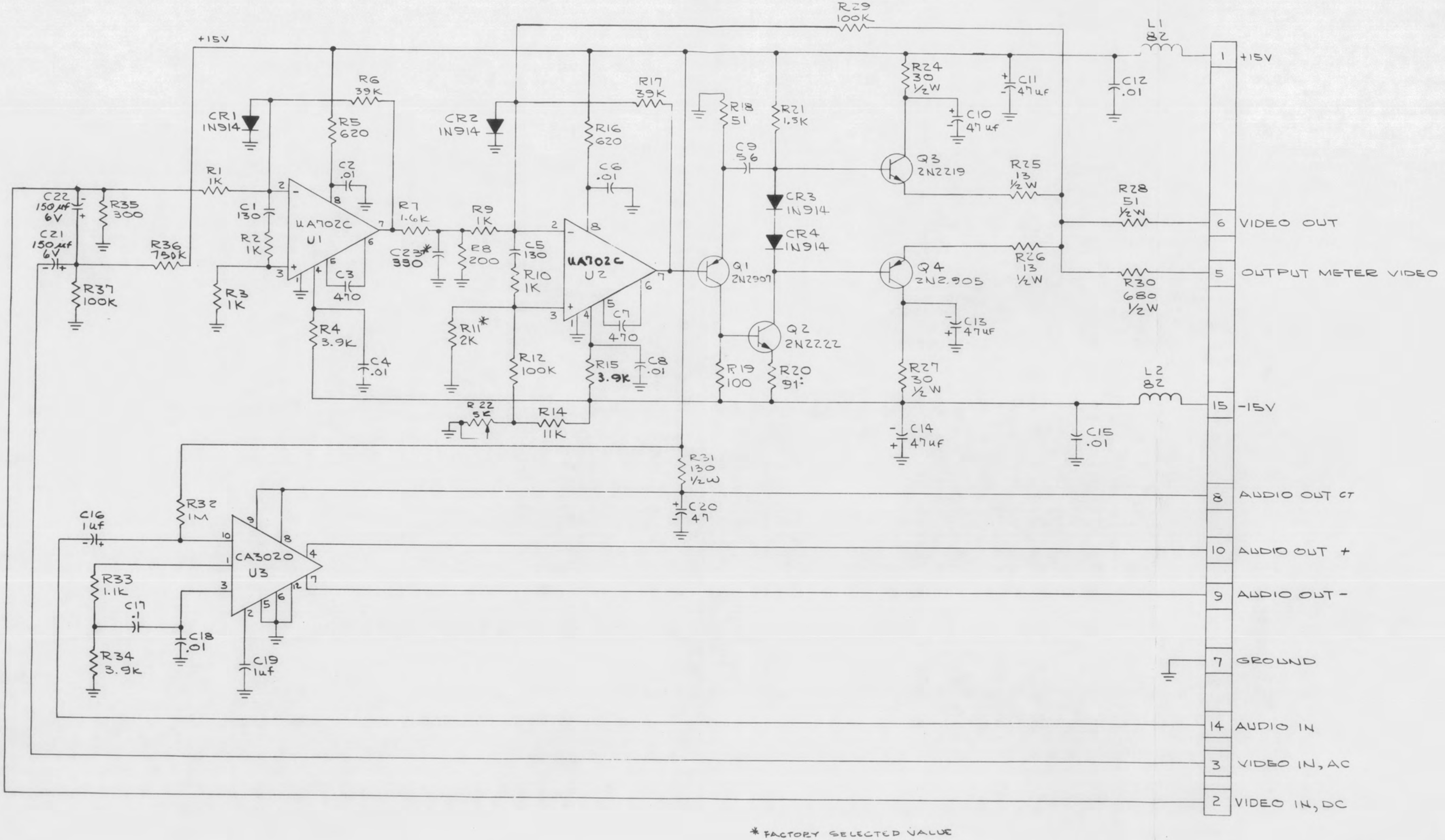


Figure 2. Video Amplifier Schematic Diagram (400-027)

Rev. November 1985

Instruction Booklet

101-938
AGC AMPLIFIER

October 1975

TRADE SECRETS

Microdyne Corporation

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AGC AMPLIFIER

GENERAL

The 101-938 AGC Amplifier module is designed for use with Microdyne telemetry equipment. Module circuitry is composed of an AGC amplifier, an AGC record amplifier, and a carrier operated relay (COR). The AGC amplifier portion of the circuit is driven by an output from the AM detector and is used to control the gain of the tuner, second mixer, and second IF filter/amplifier. It also drives the signal level meter on the parent unit front panel, the AGC record amplifier and COR amplifier. The AGC record amplifier circuit supplies a voltage output for application to an external recorder or diversity combiner. In order to provied an indication of carrier reception, the AGC voltage also controls a relay circuit which operates in conjunction with the parent unit threshold control and carrier indicator lamp. The threshold control sets the point at which the relay circuit is energized to illuminate the lamp. A schematic of the module is shown in Figure 2.

INSTALLATION

No definite installation procedures can be applied to the AGC amplifier since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedure.

THEORY OF OPERATION

The AGC amplifier consists of the AGC record amplifier U1, Q1-Q2; COR amplifier U2, Q3; and AGC integrator U3, Q4-Q5. Gain control voltages originate in the AM detector and are processed by the AGC amplifier module to control the signal level at the RF tuner, second mixer and the second IF filter/amplifier. The AGC module also provides outputs to the signal level meter, carrier indicator and the rear panel record output. Refer to the circuit schematic diagram, Figure 2.

The nominal +1.5V DC AM detector output is coupled through pin F to U3-2 and a +1.5V reference level is applied to U3-3. Any differences between the two inputs, which are measured in microvolts, are amplified by approximately 100 dB in U3. The resultant 0 to -5V DC output is coupled through buffer amplifier Q4-Q5 to the module output at pin N and to the COR amplifier U2. Additional outputs are applied to the receiver signal level ZERO control via pin M and the 60 dB calibrate control via pin 14.

The response time of U3 is determined by the positioning of the receiver AGC TIME CONSTANT MSEC switch. This switch contains a number of resistors which are configured with C3, C4, C5 and R30 to provide time constants of 0.1, 1.0, 10, 100 and 1000 milliseconds. The output of U3 is also clamped by CR3 to prevent AGC levels more positive than +2V DC.

A portion of the AGC output is applied to COR amplifier U2 which functions as a regenerative switch to control the receiver CARRIER INDICATOR lamp. In a no signal state, the positive output of U2 holds Q3 in a cutoff condition preventing an output at pin L. When the receiver is tuned to a signal above the threshold level, the output of U3 causes the output of U2 to switch to a negative voltage thereby turning on Q3. The level at which U2 switches from negative to positive is determined by the receiver COR THRESHOLD adjustment which is felt through pin P. With Q3 conducting, +15V DC is coupled through CR2 to the CARRIER INDICATOR lamp via pin L.

The conduction of Q3 also energizes relay K1, providing contact operation at pins 6, 8, 9, 10, H and J which may be used to control external indicators via the parent unit ACCESSORIES connector.

The setting of the parent base unit AGC RECORD POLARITY switch sets the configuration of U1 as an inverting (+ setting) or a non-inverting amplifier (- setting) by routing the AGC voltage to pin 2 or 3 of U1, respectively, and grounding the other pin through the input resistor. See the parent unit wiring-schematic diagram for interface connections.

The ZERO and SCALE controls are utilized to set the AGC record output to ±12V maximum for compatibility with external equipment. Setup procedures are given in the parent unit instruction manual. The output of U1 is applied to the output amplifier Q1-Q2 which drives the AGC record output at pin R.

MAINTENANCE

PREVENTIVE MAINTENANCE

The only preventive maintenance requirement is a semi-annual check of the module for loose components and corrosion. Any discrepancies noted during the inspection should be corrected either by component replacement or by module substitution.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to one of the three independent circuits; the AGC integrator, the COR amplifier or the AGC RECORD amplifier. To determine the faulty circuit, set the receiver OPERATE MODE switch to PBK, the AGC TIME CONSTANT switch to MAN and place the AGC card on the extender. Connect a DC voltmeter to pin N of the extender and adjust the receiver MAN GAIN control for a VM indication of -0.5 (±0.1)V DC. (Inability to make this adjustment indicates a fault in the AGC integrator.) Connect the DC VM to pin P of the extender and adjust the receiver COR THRESHOLD for a VM indication of 5.0 (±0.1)V DC. Inability to make this adjustment indicates a fault in the COR stage. Connect the DC VM to pin R of the extender. Set the receiver AGC RECORD POLARITY (on the rear apron) to + and adjust the AGC RECORD ZERO for a VM indication of 0 (±0.1)V DC. (Inability to make this adjustment indicates a fault in the AGC record amplifier.)

Using Voltage Chart #1, the schematic and component location diagram, check the circuit operation.

Note that some of the voltages are measured relative to card terminals which were previously set.

Voltage Chart #1

Device/Pin	1	2	3	4	5	6	7	8
U1	-15	0	0	-15	-15	R ±.03	+15	0
U2	-15	- .56	- .18	-15	-15	1 -.30	+15	0
U3	-15	+1.5	+1.5	-15	-15	N -.04	+15	0

	E	B	C
Q1	R +.15	R +.75	1 - .55
Q2	R -.15	R -.75	15 + .55
Q3	+15	+15	-15
Q4	N +.08	N +.70	1 -1.65
Q5	N -.12	N -.75	15 + .65

NOTE: Extender Board Terminals 1, 15, N and R are used as the references for differential measurements.

Set the voltage at extender pin N to -5.0 (±0.1)V DC (using the MAN GAIN control). Adjust the AGC RECORD SCALE (on the rear apron) for +10.0 (±0.1)V DC at extender pin R. Check for proper circuit operation using Voltage Chart #2.

Voltage Chart #2

Device/Pin	1	2	3	4	5	6	7	8
U1	-15	0	0	-15	-15	R + .6	+15	0
U2	-15	- .58	-1.9	-15	-15	-13	+15	0
U3	-15	+1.5	+1.5	-15	-15	N -.55	+15	0

	E	B	C
Q1	R +.15	R + .75	1 - .8
Q2	R -.15	R - .75	15 + .6
Q3	1 -.25	1 -1.0	1 - .4
Q4	N ±.1	N + .45	1 - .2
Q5	N -.35	N -1.0	15 +1.8

NOTE: Extender Board Terminals 1, 15, N and R are used as the references for differential measurements.

ALIGNMENT

After the fault has been located and corrected, the module should be tested for proper operation. The test equipment necessary for alignment is as follows:

Extender Card	Microdyne 300-423
Signal Generator	Compatible with RF tuner
DC Voltmeter	HP412A

Procedure:

a. Apply a 50 MHz, -50 dBm signal to the receiver with an HP606A signal generator.

b. The receiver AGC output level at pin N should be from -3V to -3.5V.

c. The output at pin L should cause the front panel CARRIER INDICATOR lamp to go on.

d. When the input is varied, the AGC record output should vary. If the AGC amplifier outputs are not present, refer to the voltage chart.

NOTE

When part replacement does not remedy the problem, it is recommended that the AGC card be returned to the Microdyne Corporation.

REPLACEABLE PARTS LIST (Reference Figure 1.)

Reference Designation	Description
C1, C2	Capacitor, tantalum, 47 µF ±20%, 35V, Union Carbide T362D476M035AS
C3	Capacitor, tantalum, 100 µF ±20%, 20V, Union Carbide T362D107M020AS
C4	Capacitor, tantalum, 10 µF ±20%, 25V, Union Carbide T360B106M025AS
C5	Capacitor, tantalum, 1 µF ±20%, 35V, Union Carbide T360A105M035AS
C6	Capacitor, ceramic, .001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, tantalum, 330 µF ±10%, 6V, Union Carbide T362D337K006AS
C8	Capacitor, ceramic, 47 pF ±20%, 100V, Erie 8101-100-X5R-470M
C9	Capacitor, tantalum, 2.2 µF ±20%, 20V, Union Carbide T360A225M020AS
C10	Capacitor, paper, 0.1 µF ±10%, 80V, Sprague 192P1049R8
C11	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
C12, C13	Capacitor, ceramic, 68 pF ±5%, 100V, Erie 8131-100-COG-680J
CR1, CR2	Diode, silicon, rectifier, JEDEC 1N4001
CR3	Diode, silicon, signal, JEDEC 1N914
K1	Relay, DPDT, GE 3SAV5004L1
L1, L2	Inductor, 82 µH ±5%, Airco-Speer 1315-10J
Q1, Q4	Transistor, NPN, Si, To-18, JEDEC 2N2222
Q2, Q3	Transistor, PNP, Si, To-18, JEDEC 2N2907

Replaceable Parts List, continued

Reference Designation	Description
Q5	Transistor, PNP, Si, To-5, JEDEC 2N2906
R1, R2	Not Assigned
R3	Resistor, fixed composition, 1.6K ±5%, ¼w, Allen Bradley CB1625
R4, R6	Resistor, metal film, 36.5K ±1%, 1/8w, QPL RN55D3652F
R5, R7	Resistor, metal film, 7.5K ±1%, 1/8w, QPL RN55D7501F
R8	Resistor, fixed composition, 51K ±5%, ¼w, Allen Bradley CB5135
R9	Resistor, fixed composition, 8.2K ±5%, ¼w, Allen Bradley CB8225
R10	Resistor, fixed composition, 18K ±5%, ¼w, Allen Bradley CB1835
R11	Resistor, metal film, 10K ±1%, 1/8w, QPL RN55D1002F
R12	Not Assigned
R13, R16	Resistor, precision, 6.19K ±1%, 1/8w, MIL RN55D6191F
R14, R15	Resistor, precision, 332Ω ±1%, 1/8w, MIL RN55D3320F
R17, R20	Resistor, fixed composition, 110Ω ±5%, 2w, Allen Bradley HB1115
R18, R19	Resistor, fixed composition, 30Ω ±5%, ½w, Allen Bradley EB3005
R21	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R22	Resistor, fixed composition, 6.2K ±5%, ¼w, Allen Bradley CB6225
R23	Resistor, fixed composition, 30K ±5%, ¼w, Allen Bradley CB3035
R24	Resistor, fixed composition, 3.9K ±5%, ¼w, Allen Bradley CB3925
R25	Resistor, fixed composition, 3.0M ±5%, ¼w, Allen Bradley CB3055
R26	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R27	Resistor, fixed composition, 15K ±5%, ¼w, Allen Bradley CB1535
R28	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R29	Resistor, fixed composition, 47Ω ±5%, 1/8w, Allen Bradley BB4705
R30	Resistor, fixed composition, 5.6K ±5%, ¼w, Allen Bradley CB5625
R31	Resistor, fixed composition, 5.1K ±5%, ¼w, Allen Bradley CB5125
R32	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R33	Resistor, fixed composition, 2.7K ±5%, ¼w, Allen Bradley CB2725
R34, R37	Resistor, precision, 8.25K ±1%, 1/8w, MIL RN55D8251F
R35, R36	Resistor, precision, 432Ω ±1%, 1/8w, MIL RN55D4320F
R38	Resistor, fixed composition, 560Ω ±5%, ½w, Allen Bradley EB5615
R39, R40	Resistor, fixed composition, 30Ω ±5%, ¼w, Allen Bradley CB3005
R41	Resistor, fixed composition, 150Ω ±5%, 2w, Allen Bradley HB1515
U1 thru U3	Operational Amplifier, G.P., Mini Dip, Nat'l Semi LM741CN
XQ1 thru XQ5	Transipad to 5, to 18, Milton Ross 10109 (10044 may be used in place of 10109)
XK1	Transipad, relay, Milton Ross 10105
XU1 thru XU3	Socket, 8 pin, Mini Dip, Augat 508-AG1D

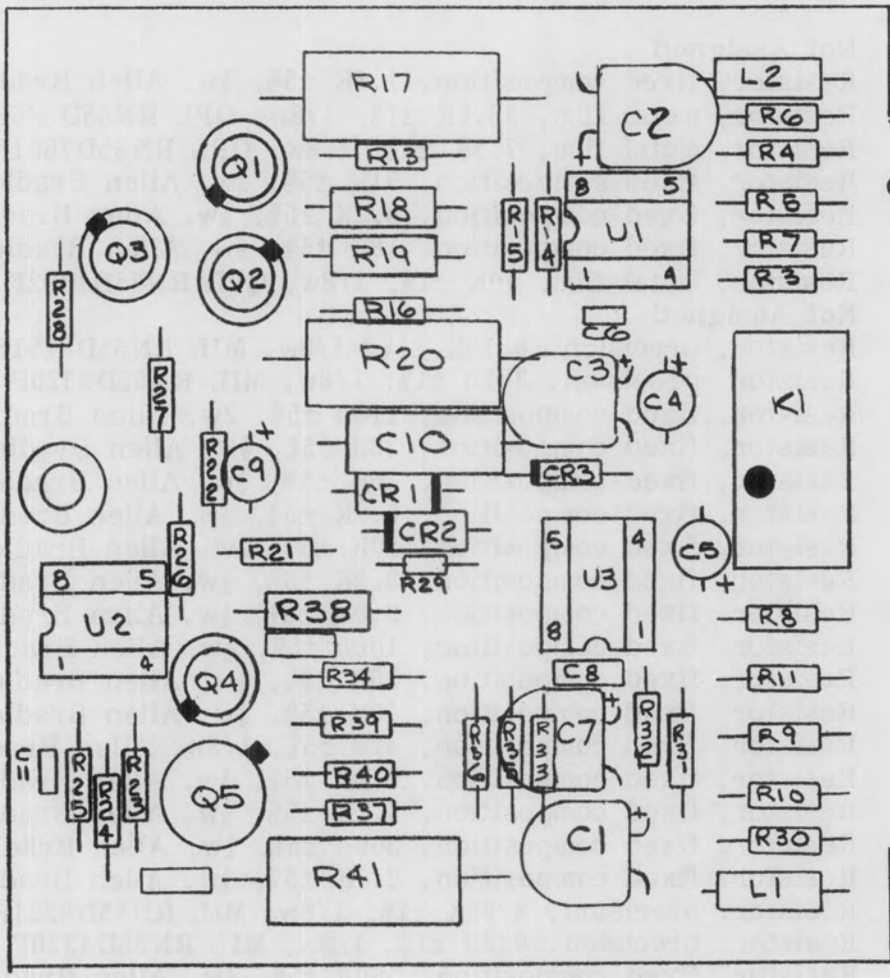


Figure 1. Component Location Drawing

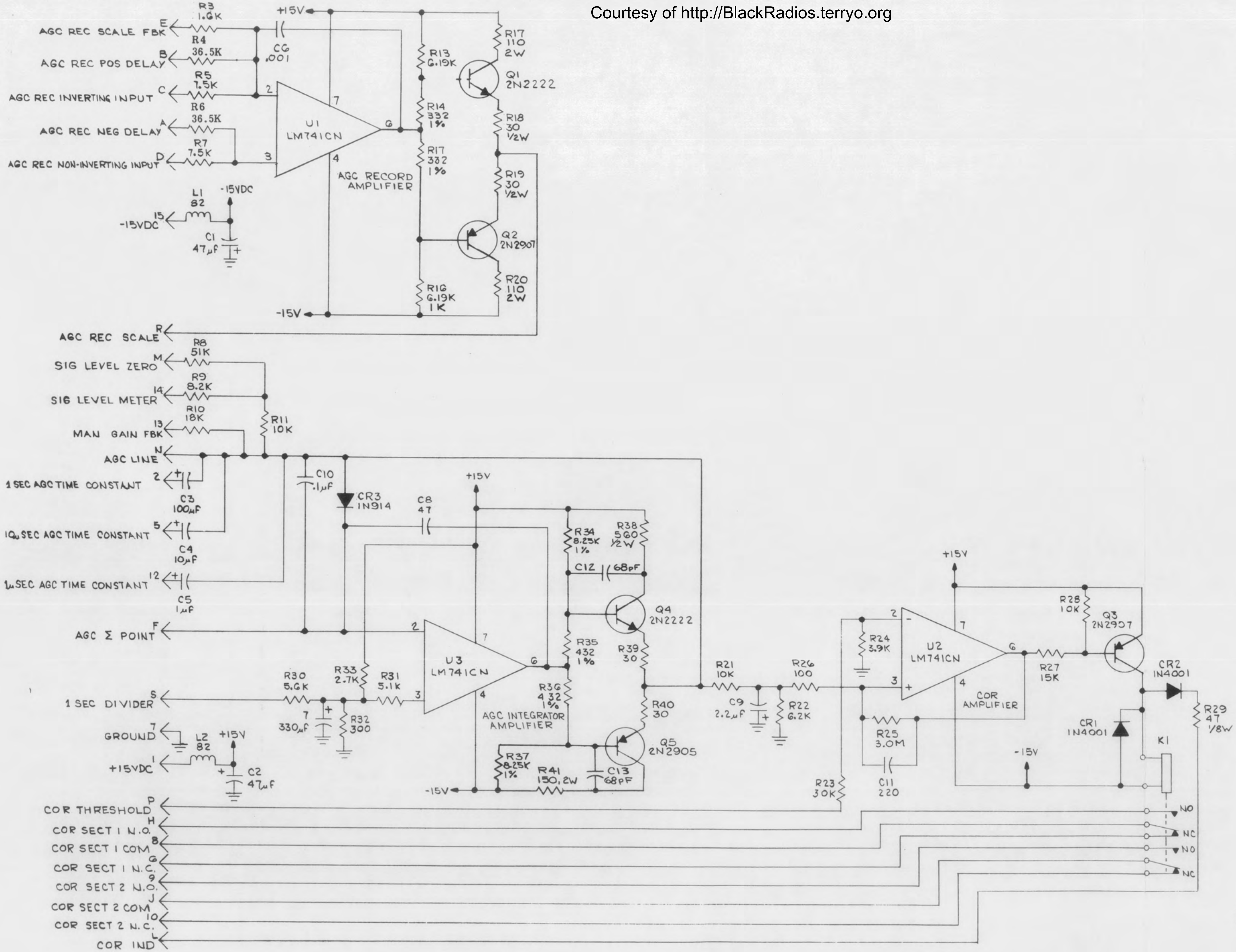


Figure 2. AGC Amplifier Schematic Diagram

METERING AMPLIFIER

GENERAL

The 300-089 Metering Amplifier is designed for use with Microdyne telemetry equipment and accepts inputs from the associated parent unit demodulator and video amplifier. These signals are then amplified and rectified, and applied to front panel deviation and video output level meters. A schematic diagram of the module is shown in Figure 2.

INSTALLATION

No definite installation procedures are applicable to the metering amplifier since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedures.

The metering amplifier is constructed on a printed circuit board which plugs into a parent unit receptacle.

THEORY OF OPERATION

The metering amplifier consists of two integrated circuit amplifiers, U1 and U2, and the crystal oven heater control circuit composed of transistors Q1, Q2 and Q3. These stages perform the following functions: they amplify the signal received from the demodulator, rectify it, and apply it to a deviation meter; secondly, they amplify the received signal from a video amplifier, rectify it, and apply it to the front panel output level meter; thirdly, they act as a thermistor bridge amplifier and current source driver for the crystal oven in the parent unit RF tuner module.

The video input at pin 5, from the parent unit OUTPUT dB CAL control, is amplified by U1 and peak detected by CR5 and CR6 prior to being applied to the front panel OUTPUT dB meter via pin 11. Diodes CR3 and CR4 are utilized to obtain DC feedback for the amplifier circuitry.

The deviation signal input, originating in the demodulator, is applied to pin 2 and fed to amplifier U2 where it is amplified, peak detected and applied to a deviation meter through pin 3. Potentiometer R28 is provided to set the output level for compatibility with the requirements of various parent units.

The oven sensor input at pin 14 is applied to the oven heater control circuit. When the sensor signal increases, conduction in transistor Q2 is increased causing a corresponding decrease in the conduction of transistor Q1, thereby decreasing the current flow through the heater. When the sensor signal decreases, the conduction in transistor Q2 is decreased which causes a corresponding increase in the conduction of transistor Q1, thereby increasing the current flow through the heater.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the metering amplifier consist of a semi-annual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components. Any defects observed during the inspec-

Preventive Maintenance, continued

tion should be corrected immediately.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry; amplifier U1, amplifier U2 and the crystal oven heater control circuit. This is accomplished by injecting a test signal as in steps e and f of the alignment procedure and observing whether the associated OUTPUT and DEVIATION meters are functioning. If the OUTPUT meter is inoperative, the fault lies in U1 and associated circuitry. Should the DEVIATION meter be inoperative, troubleshoot the circuitry associated with U2. A failure in the oven control circuit will be indicated by the RF tuner crystal oven not heating. Once the defective circuit has been located, the faulty component should be detected and replaced. Refer to Figure 1 for component location of the metering amplifier. The following voltage chart is provided as an aid to troubleshooting the metering amplifier. The voltages were obtained with an HP412A DC voltmeter under "no signal" conditions, and may vary ±20% between modules.

Device	1	2	3	4	5	6
U1	+1 mV	-1 mV	-2 mV	-5.9	+4.2	+0.6
U2	-7.5	-6.8	-	-14.6	+15	-6

Device	7	8	9	10	11	12
U1	+0.025	+15	-			
U2	-5.2	+5	-6	-15	+15	-6

Device	E	B	C
Q1	-2.9	-3.7	-3
Q2	-3.8	-3.1	-3.7
Q3	-3.8	-4.4	0

REPAIR

All components contained in the metering amplifier module are considered non-repairable and must be replaced when found defective. Components should be replaced with identical items, as described in the replacement parts list, for optimum performance.

ALIGNMENT

After the fault has been located and corrected, the module should be realigned. The test equipment necessary for alignment is as follows:

Extender Card	Microdyne 300-423
Signal Generator	As required
AC Voltmeter	HP3400A
Test Oscillator	HP652A

Alignment, continued

a. Install the tuner and the demodulators in the receiver.

b. Place the metering amplifier module on the extender card.

c. Connect the signal generator to the RF input. Connect the HP652A to the generator modulation input.

d. Connect the AC voltmeter to pin 2 of the extender card. Terminate the voltmeter in 75 ohms.

e. Set the signal generator for a 1 mV RF output at a frequency within the range of the tuner. Tune the receiver to the signal. Set the demodulator DEVIATION switch to its maximum position.

f. Set the HP652A for a modulating frequency of 1.7 KHz. Adjust the modulation level until the AC voltmeter indicates 15(±0.1) mV rms.

g. Adjust R28 on the metering amplifier for a full-scale indication on the DEVIATION meter.

h. If the deviation required to obtain a full-scale meter indication is other than the full-scale level engraved on the meter, check the operation of the parent unit demodulator.

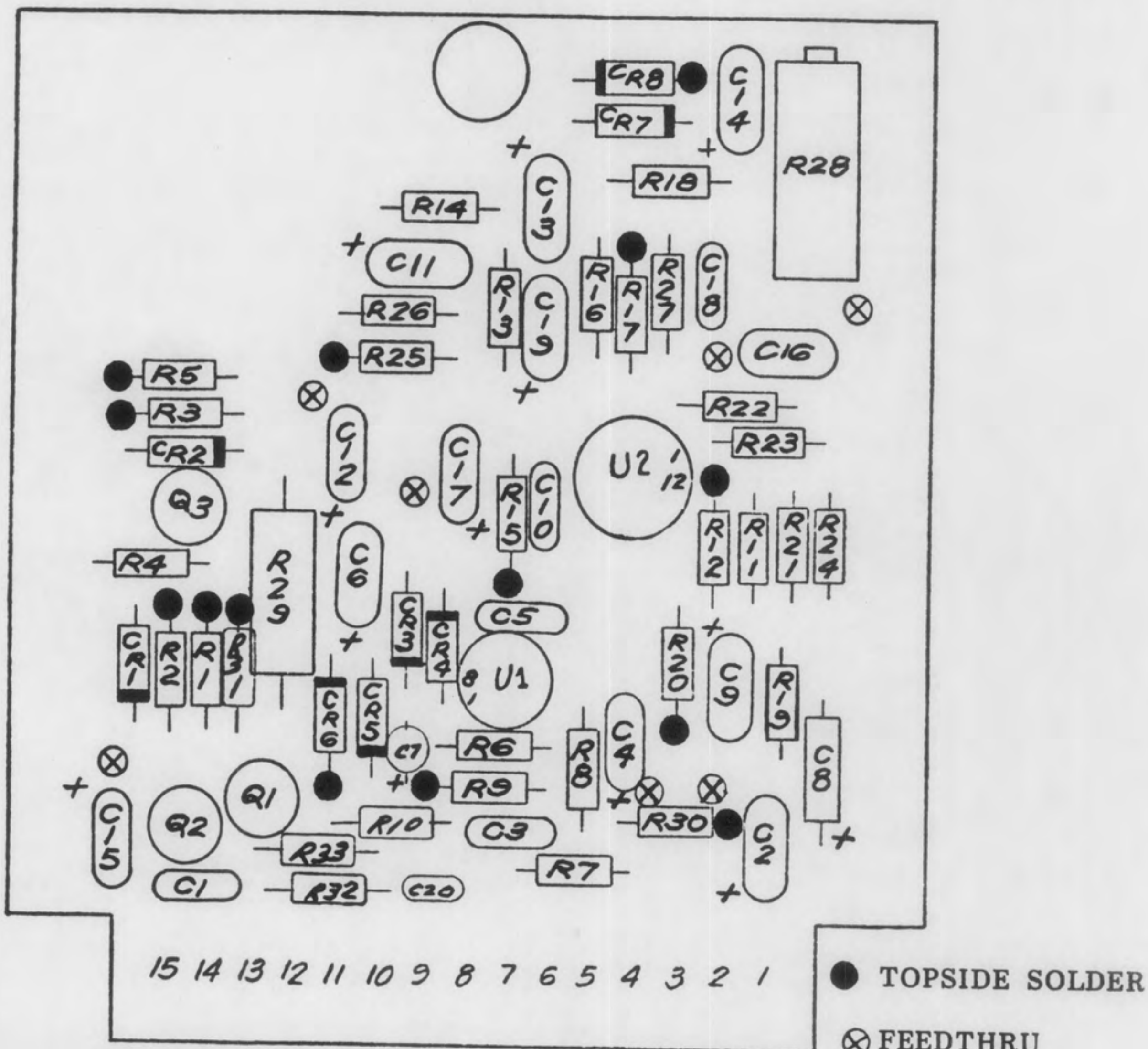
i. Disconnect the test equipment.

REPLACEMENT PARTS LIST

Reference Designation	Description
C1	Capacitor, ceramic, .015 µF ±20%, 100V, Erie 8131-100-X5V-153M
C2	Capacitor, tantalum, 100 µF ±20%, 20V, Kemet K100E20
C3	Capacitor, ceramic, 1000 pF ±5%, 100V, Erie 8121-100-COG-102J
C4	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet K10E20
C5	Capacitor, ceramic, 750 pF ±5%, 100V, Erie 8121-100-COG-751J
C6, C7	Capacitor, tantalum, 15 µF ±10%, 20V, Kemet T362B156M020AS
C8	Capacitor, paper, .47 µF, Sprague 150D474X9035A2
C9	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet K10E20
C10	Capacitor, ceramic, 1.3 pF ±.1 pF, 100V, Erie 8101-100-COG-139B
C11, C12	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet K10E20
C13, C14	Capacitor, tantalum, 100 µF ±20%, 20V, Kemet K100E20
C15, C19	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet K10E20
C16, C17	Capacitor, tantalum, 47 µF ±20%, 20V, Kemet K47E20
C18	Capacitor, ceramic, 3 pF ±.1 pF, 100V, Erie 8101-100-COG-309B
C20, C21	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
CR1, CR2	Diode, Sylvania 1N914
CR3 thru CR8	Diode, Sylvania 1N277
Q1	Transistor, Motorola 2N2907
Q2, Q3	Transistor, Motorola 2N2222
R1	Resistor, fixed composition, 510 Ω ±5%, ¼w, Allen Bradley CB5115
R2, R3	Resistor, metal film, 10K ±1%, 1/8w, QPL RN55D1002F

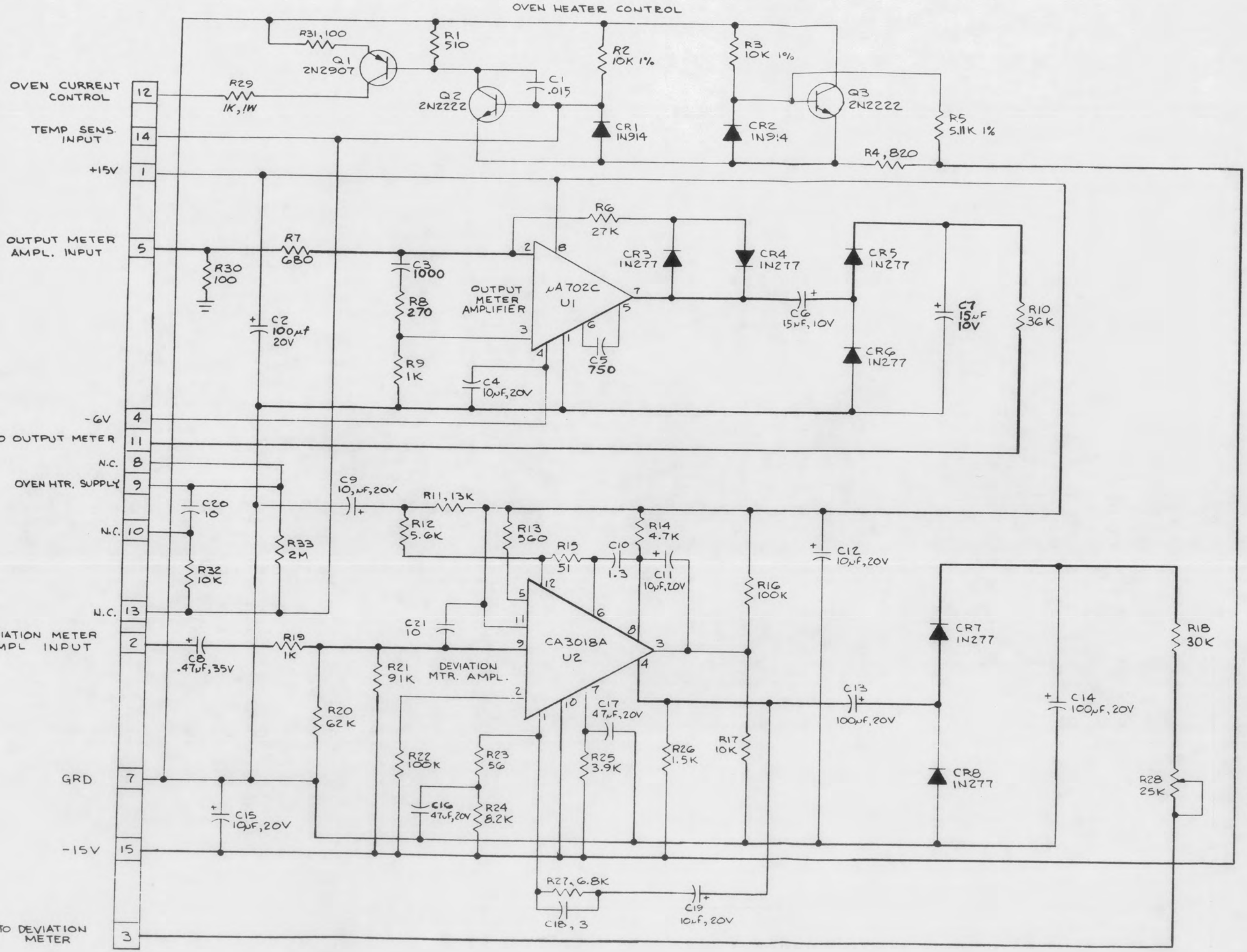
Replacement Parts List, continued

Reference Designation	Description
R4	Resistor, fixed composition, 820Ω ±5%, ¼w, Allen Bradley CB8215
R5	Resistor, metal film, 5.1K ±1%, 1/8w, QPL RN55D5111F
R6	Resistor, fixed composition, 27K ±5%, ¼w, Allen Bradley CB2735
R7	Resistor, fixed composition, 680Ω ±5%, ¼w, Allen Bradley CB6815
R8	Resistor, fixed composition, 270Ω ±5%, ¼w, Allen Bradley CB2715
R9	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R10	Resistor, fixed composition, 36K ±5%, ¼w, Allen Bradley CB3635
R11	Resistor, fixed composition, 13K ±5%, ¼w, Allen Bradley CB1335
R12	Resistor, fixed composition, 5.6K ±5%, ¼w, Allen Bradley CB5625
R13	Resistor, fixed composition, 560Ω ±5%, ¼w, Allen Bradley CB5615
R14	Resistor, fixed composition, 4.7K ±5%, ¼w, Allen Bradley CB4725
R15	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R16	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R17	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R18	Resistor, fixed composition, 30K ±5%, ¼w, Allen Bradley CB3035
R19	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R20	Resistor, fixed composition, 62K ±5%, ¼w, Allen Bradley CB6235
R21	Resistor, fixed composition, 91K ±5%, ¼w, Allen Bradley CB9135
R22	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R23	Resistor, fixed composition, 56Ω ±5%, ¼w, Allen Bradley CB5605
R24	Resistor, fixed composition, 8.2K ±5%, ¼w, Allen Bradley CB8225
R25	Resistor, fixed composition, 3.9K ±5%, ¼w, Allen Bradley CB3925
R26	Resistor, fixed composition, 1.5K ±5%, ¼w, Allen Bradley CB1525
R27	Resistor, fixed composition, 6.8K ±5%, ¼w, Allen Bradley CB6825
R28	Potentiometer, 25K, Beckman 89WR25K
R29	Resistor, fixed composition, 1K ±5%, 1w, Allen Bradley GB1025
R30, R31	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R32	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R33	Resistor, fixed composition, 2M ±5%, ¼w, Allen Bradley CB2055
U1	Integrated Circuit, Fairchild μA702
U2	Integrated Circuit, RCA CA3018A



C21 connected across U2

Figure 1. Metering Amplifier Component Location Diagram



NOTE:

1. UNLESS OTHERWISE NOTED:
   CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
   CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
   INDUCTANCE VALUES ARE IN MICROHENRYS.
   RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

Figure 2. Metering Amplifier Schematic Diagram (400-029)

Rev. October 1984

Instruction Booklet

300-078
AFC AMPLIFIER

December 1972

TRADE SECRETS

Microdyne Corporation

POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
Telephone (301) 762-8500

AFC AMPLIFIER

GENERAL

The AFC amplifier is utilized in Microdyne telemetry equipment to supply automatic frequency control of the parent unit second local oscillator. Should the parent unit be equipped with a phase demodulator, the AFC amplifier operates in conjunction with the phase demodulator to supply the oscillator with automatic phase control voltages (APC). Outputs are also supplied to the parent unit tuning meter as an indication of the AFC or APC loop stress, and for controlling a front panel search indicator lamp. A schematic diagram of the module is shown in Figure 2.

INSTALLATION

AFC amplifier circuitry is mounted on a printed circuit card which plugs into a designated receptacle in the base unit. Any special procedures required to remove or install the module are given in the parent unit instruction manual.

THEORY OF OPERATION

The AFC amplifier is composed of acquisition amplifier U2-Q4, retrace amplifier U1-Q1-Q2-Q3, integrator U3, and FET switches Q5 and Q6. See Figure 2.

In actual operation, the AFC amplifier functions in either a locked or sweeping mode to control the frequency of the second local oscillator. When the AFC loop is locked and tracking, acquisition amplifier is held on by a voltage input from the AM detector and carrier indicator lamp. With U2 on, Q4 is off, turning off the parent unit search lamp, and FET Q6 is on, coupling the AFC/APC input from the demodulator to integrator U3.

U3 functions as an infinite gain stage to couple the AFC/APC control voltage from the demodulator to the second local oscillator module for frequency control. Response time of the stage is determined by a capacitor in the demodulator module which is electrically connected between pins 11 and 8 on the AFC module. Potentiometer R30 is provided as the balance adjustment.

Should the AFC tracking loop be broken, acquisition amplifier U2 is shut off by the input from the receiver carrier indicator lamp. With U2 off, Q4 is turned on providing the circuit ground to illuminate the receiver search lamp. At the same time Q6 is turned off, Q5 is turned on connecting retrace amplifier (U1, Q1, Q2, Q3) across integrator U3. These two stages then function together to generate a ramp output employed to sweep the second local oscillator over its tuning range. The center frequency of the oscillator is determined by the positioning of the parent unit fine tune control. Frequency excursions on either side of the selected center frequency are set by the integrator/retrace amplifier. These limits are in turn controlled by the positioning of the parent unit search range control electrically connected to U1 via pin 10. Voltage limits are from 600 mV p-p at minimum search range to 20V ±3V p-p at maximum search range. Transistor Q1 in the retrace amplifier serves to amplify the regenerative feedback to maintain the ramp output. Transistors Q2 and Q3 serve as amplifiers to the ramp signal. This amplification is necessary because of the voltage divider in the associated FM demodulator and electrically connected between pins 9 and 14 of the AFC module. The voltage divider is utilized to maintain the ±250 KHz sweep range regardless of whether the narrow, intermediate or wide band demodulator circuit is used.

Theory of Operation, continued

The module will generate the ramp output until the voltage input from the AM detector and that from the carrier indicator lamp are indicative that a carrier is present in the IF passband. Once these conditions are met, the acquisition amplifier is turned on to disable the sweep, turn off the search lamp, and configure U3 as an infinite gain stage to couple the AFC signal to the oscillator module.

When the AFC amplifier is utilized with a phase demodulator, the acquisition amplifier is not utilized. Parent unit wiring configures the retrace amplifier section with the demodulator ramp generator circuit and U3 is employed as an operational amplifier only. A complete description of the use of these stages for PM operation is given in the phase demodulator instruction manual.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the AFC amplifier consist of a semi-annual check of the connector for corrosion and loose pins, and the module itself, for signs of damage and loose components. Any discrepancies should be corrected by component replacement or module substitution.

TROUBLESHOOTING

In the event of a malfunction, the problem must first be isolated to one of the three main circuits: retrace amplifier, acquisition amplifier or integrator/operational amplifier. This is accomplished as follows:

a. If the associated receiver search indicator can be turned on and off by the application of an RF signal to the receiver, the acquisition amplifier circuit is operative. If the indicator cannot be controlled in this manner, compare the DC voltages at pins 2, 3 and 6 of U2 with those given in the following table. If present, check the base voltage at Q4 with that in the table plus condition of CR2 - open or shorted.

b. Connect a DC voltmeter to pin 11 of the module and adjust R30 from stop to stop. This action should cause the level at pin 11 to cross through 0V DC from a positive to a negative voltage or vice versa (the actual level is not important only the action of a voltage swing through 0V is). If the swing cannot be obtained, replace U3.

c. If all indications in steps a and b are obtained, check the retrace amplifier by measuring the base to emitter voltage drop of Q1, Q2 and Q3. If these components are operating, there will be a 0.7V drop across the two points. Also check the condition of CR1 (open or shorted). If all conditions are met, compare the voltages at U1 pins 2, 3 and 6 with those in the following table. In addition, connect an oscilloscope to pin 6 of U1 and observe a signal switching from +15V to -15V DC. Should this level be absent, replace U1. If present, check for the same signal at the (-) input of U3. If this level is absent, replace Q5. If this level is present, balance

Troubleshooting, continued

c. the FM demodulator per its instruction manual (balance is not required in the PM demodulator). Next, apply a 10 mV signal to the receiver at a frequency in the middle of the applicable RF tuner range. Tune the receiver to the signal with the 1ST and 2ND LO MODE switches set to VFO for an FM demodulator or to XTAL for a phase demodulator. With the receiver tuned (10.000 MHz IF output measured at the receiver 10 MHz linear output connector), the voltage at the (-) input of U3 should be 0V DC. If other than 0V DC, replace Q6.

The voltage table given below provides the voltage levels necessary for troubleshooting the AFC amplifier module. The voltage levels given are dynamic levels since the AFC module cannot be checked in a static condition. Voltages were measured with an HP412A DC voltmeter and may vary ±20% between units.

Table 1.

Device	Pin Numbers	Voltage
U1	2	+190 mV
	3	- 24 mV
	6	-12.4V
U2	2	+ 7.78V
	3	+ 1.64V
	6	+ 13.6V
Q1	Collector	+ 13.6V
Q2	Base	+ 13.5V
	Emitter	+ 14.4V
	Collector	+ 14.3V
Q3	Base	- 12.6V
	Collector	- 13.1V
Q4	Base	-590 mV
Q5	2 (gate)	- 12.4V
Q6	2 (gate)	- 12.4V

Refer to Figure 1 for component location of the AFC amplifier.

ALIGNMENT

The following alignment procedure should be followed when aligning the AFC amplifier module. This procedure requires that the module be inserted in the parent unit with a Microdyne module extender card. This procedure requires the following equipment:

Extender Card	Microdyne 300-423
Oscilloscope	HP180A
DC Voltmeter	HP412A

Procedure:

a. Install the module in the parent unit with the extender card.

b. With the FM demodulator installed in the parent unit, set the 2ND LO MODE switch to the XTAL position.

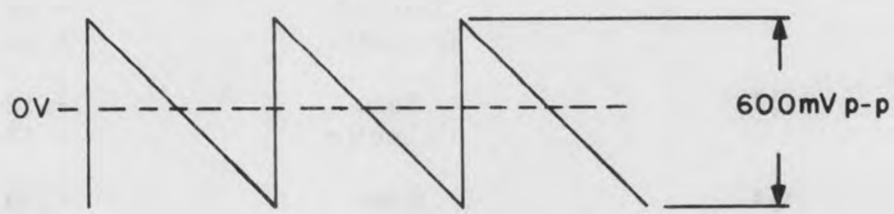
c. Connect the DC voltmeter to pin 11 of the module.

d. Adjust R30 on the AFC module for 0 (±0.5) mV DC voltmeter reading.

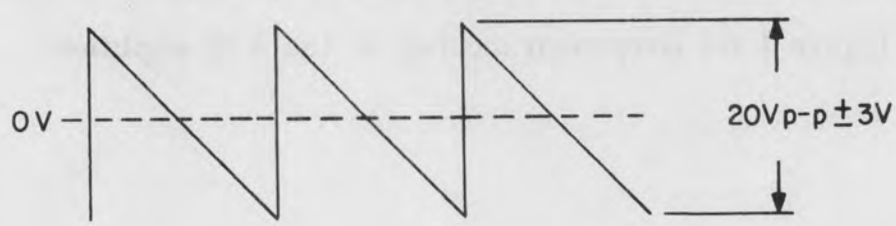
e. Set the 2ND LO MODE switch on the parent unit to the AFC position.

f. Connect the HP180A oscilloscope to pin 11. Set the SEARCH RANGE control on the parent unit fully counterclockwise.

g. Insure that the calibration/reference oscillator is not enabled. The oscilloscope should display a sawtooth waveform and the AUTO SEARCH lamp on the parent unit should be illuminated.



h. Slowly turn the SEARCH RANGE control on the parent unit to a fully clockwise (maximum) position. Adjust potentiometer R37 on the AFC amplifier module for a vertical deflection which is symmetrical about 0V DC.



i. Disconnect the test equipment and return the module to the parent unit.

REPLACEMENT PARTS LIST

Reference Designation	Description
C1	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
C2	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C3	Capacitor, ceramic, 47 pF ±20%, 100V, Erie 8101-100-X5R-470M
C4, C5	Capacitor, electrolytic, 47 µF ±20%, 20V, Kemet K47E20
C6	Capacitor, tantalum, .47 µF ±20%, 35V, Sprague CS13BF474K
C7	Capacitor, electrolytic, 47 µF ±20%, 20V, Kemet K47E20
C8	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
C9	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C10, C11	Capacitor, tantalum, 3.3 µF ±20%, 15V, Sprague CS13BD335K
C12, C13	Capacitor, ceramic, .01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
*C14	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COG-151J if U3 is Zoltex 133 or Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8121-100-COG-470J if U3 is Philbrick Nexus QFT-2 or Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8121-100-COG-470J if U3 is Analog Devices 43K
CR1 thru CR3	Diode, silicon, Sylvania 1N914
CR4	Diode, zener, silicon, JEDEC 1N748
Q1, Q3	Transistor, NPN, Motorola 2N3947
Q2	Transistor, PNP, Motorola 2N3251
Q4	Transistor, NPN, Motorola 2N2222
Q5	Transistor, FET, Motorola 2N4351
Q6	Transistor, FET, Motorola 2N4352
R1	Resistor, fixed composition, 18K ±5%, ¼w, Allen Bradley CB1835
R2 thru R4	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R5	Resistor, fixed composition, 1.5K ±5%, ¼w, Allen Bradley CB1525
R6	Resistor, fixed composition, 360K ±5%, ¼w, Allen Bradley CB3645
R7	Resistor, fixed composition, 15K ±5%, ¼w, Allen Bradley CB1535
R8 thru R11	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R12	Resistor, fixed composition, 62K ±5%, ¼w, Allen Bradley CB6235
R13	Resistor, fixed composition, 15K ±5%, ¼w, Allen Bradley CB1535
R14	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R15	Resistor, fixed composition, 750 Ω ±5%, ¼w, Allen Bradley CB7515
R16	Resistor, fixed composition, 3K ±5%, ¼w, Allen Bradley CB3025
R17	Resistor, fixed composition, 47K ±5%, ¼w, Allen Bradley CB4735
R18	Resistor, fixed composition, 20K ±5%, ¼w, Allen Bradley CB2035
R19, R20	Resistor, fixed composition, 10K ±5%, ¼w, Allen Bradley CB1035
R21	Resistor, fixed composition, 750K ±5%, ¼w, Allen Bradley CB7545
R22	Resistor, fixed composition, 1.5K ±5%, ¼w, Allen Bradley CB1525
R23, R25	Resistor, fixed composition, 20K ±5%, ¼w, Allen Bradley CB2035
R24	Resistor, fixed composition, 100K ±5%, ¼w, Allen Bradley CB1045
R26	Resistor, fixed composition, 160 Ω ±5%, ¼w, Allen Bradley CB1615
R27, R28	Resistor, fixed composition, 1M ±5%, ¼w, Allen Bradley CB1055

* Depends on Operational Amplifier used.

Replacement Parts List, continued

Reference Designation	Description
R29	Resistor, fixed composition, 47K ±5%, ¼w, Allen Bradley CB4735
*R30	Potentiometer, 5K, 3/4w, Beckman 89WR5K if U3 is Zoltex 133 or Potentiometer, 1K, 3/4w, Beckman 89WR1K if U3 is Nexus QFT-2 or Potentiometer, 1K, 3/4w, Beckman 89WR1K if U3 is Analog Devices 43K
R31, R32	Resistor, fixed composition, 47Ω ±5%, ¼w, Allen Bradley CB4705
R33	Resistor, fixed composition, 62K ±5%, ¼w, Allen Bradley CB6235
R34	Resistor, fixed composition, 750K ±5%, ¼w, Allen Bradley CB7545
R35	Resistor, fixed composition, 1K ±5%, ¼w, Allen Bradley CB1025
R36	Resistor, fixed composition, 1M ±5%, ¼w, Allen Bradley CB1055
R37	Potentiometer, 100K, 1/2w, Allen Bradley SV1041
R38	Resistor, fixed composition, 6.2K ±5%, ¼w, Allen Bradley CB6225
R39	Resistor, fixed composition, 15K ±5%, ¼w, Allen Bradley CB1535
U1, U2	Integrated Circuit, Fairchild μA709C
U3	Operational Amplifier, Zoltex 133 or Nexus QFT-2 or Analog Devices 43K

* Depends on Operational Amplifier used.

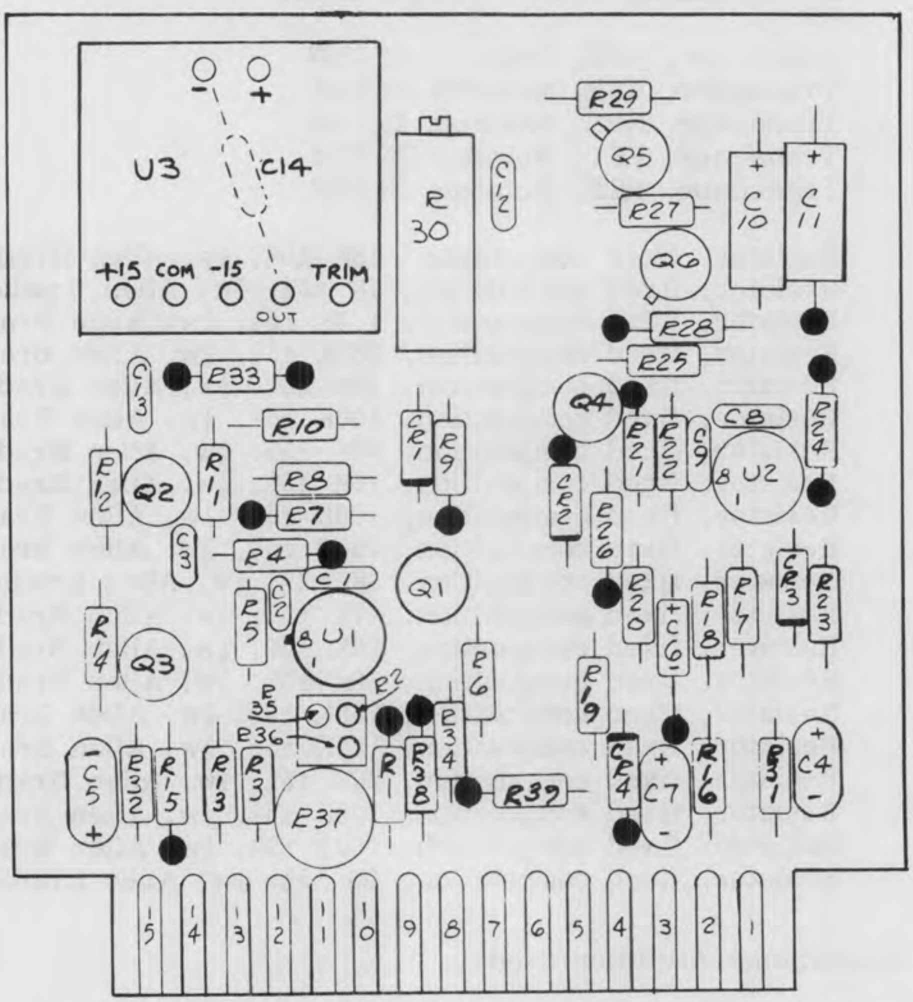
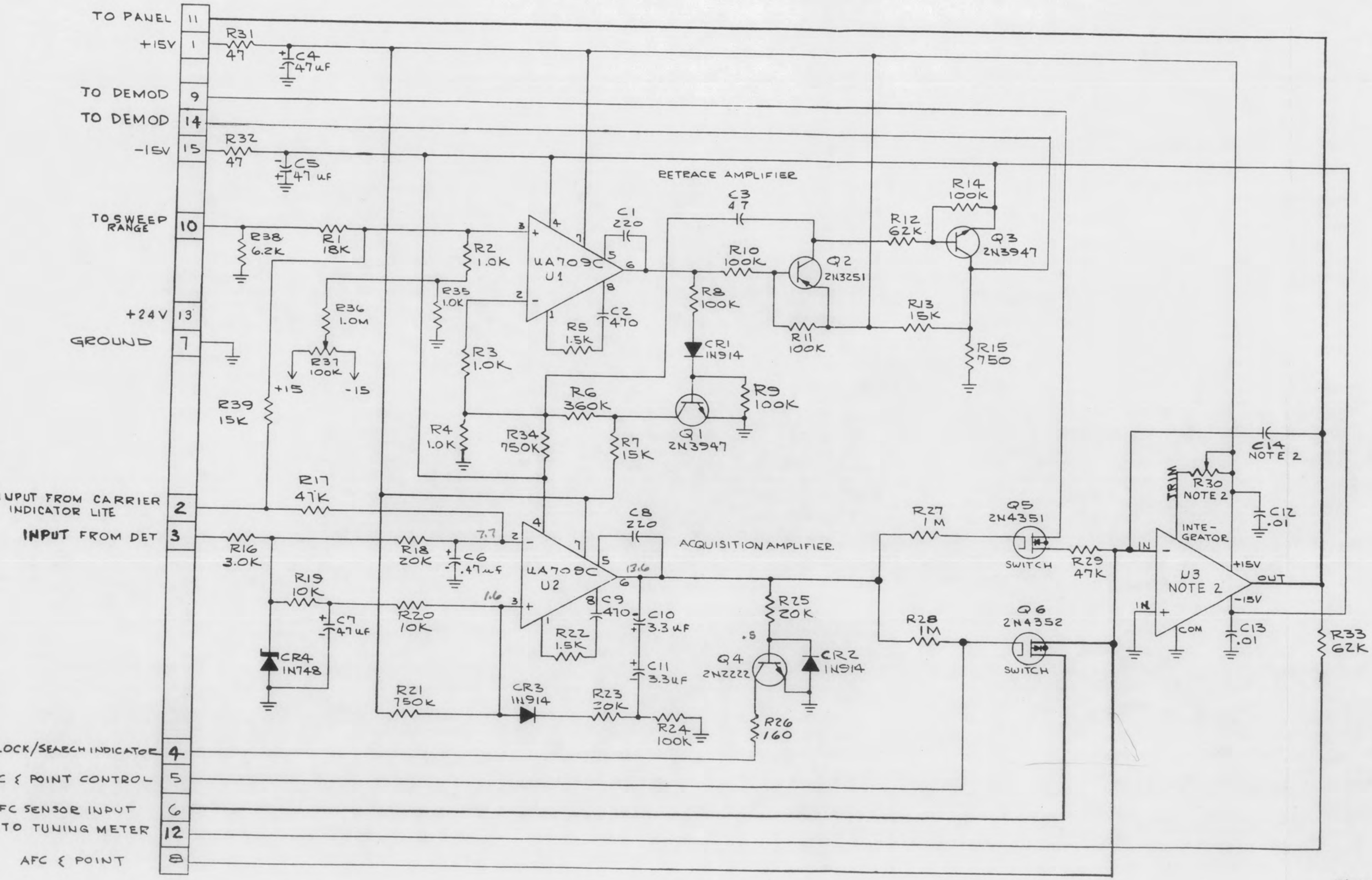


Figure 1. AFC Amplifier Component Location Diagram



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   CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
   INDUCTANCE VALUES ARE IN MICROHENRYS.
   RESISTOR VALUES ARE IN OHMS K=1000, M=1,000,000.

Figure 2. AFC Amplifier Schematic Diagram (400-030)